DOCUMENT RESUME

ED 144 796 SE 023 053

TITLE National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council, Annual Report Fiscal Year 1975-76. Committee on Labor and Public Welfare, 94th Congress, 2nd Session.

INSTITUTION Congress of the U.S., Washington, D.C. Senate Committee on Labor and Public Welfare.

REPORT NO Sen-Doc-94-258

PUB DATE 76

NOTE 503p.; Contains occasional small print

EDRS PRICE MF-$1.00 HC-$27.45 Plus Postage.

DESCRIPTORS *Annual Reports; *Engineering Education; *Medical Education; *Reports; Science Programs; Science Projects; *Sciences; Scientific Enterprise; Scientific Research

IDENTIFIERS *National Academy of Sciences

ABSTRACT

Presented is the annual report for fiscal year 1975-76 of the National Academy of Sciences (NAS), including the annual reports of the National Academy of Engineering and the Institute of Medicine. Contents include: (1) report of the President; (2) reports on completed studies including food and nutrition, public health, natural resources, space applications, and disaster studies; (3) reports of international activities; (4) report of the National Research Council including behavioral and social sciences, engineering, life sciences, mathematical and physcial sciences, human resources, natural resources, and sociotechnical systems; and (4) the report of the treasurer. (SL)

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94th Congress, 2d Session

Senate Document No. 94–258

NATIONAL ACADEMY OF SCIENCES

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ANNUAL REPORT
FISCAL YEAR 1975–76

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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NATIONAL ACADEMY OF SCIENCES

NATIONAL ACADEMY OF ENGINEERING

INSTITUTE OF MEDICINE

National Research Council

ANNUAL REPORT
FISCAL YEAR 1975-76

September 21, 1976.—Referred to the Committee on Labor and Public Welfare and ordered to be printed with an illustration pursuant to law

LETTER OF TRANSMITTAL

NATIONAL ACADEMY OF SCIENCES,
Washington, D.C., August 23, 1976.

SIRS: I have the honor to transmit to you herewith the annual report of the National Academy of Sciences for fiscal year 1976. Included in this report are the annual reports of the National Academy of Engineering and the Institute of Medicine, covering the period July 1, 1975, through June 30, 1976.

Very truly yours,

PHILIP HANDLER,
President.

The President of the Senate
The Speaker of the House of Representatives

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PREFACE

The scientific and technical studies of the National Academy of Sciences (NAS) and the National Academy of Engineering (NAE) during fiscal year 1976 have been delegated to appropriate assemblies and commissions of the National Research Council (NRC). The Institute of Medicine (IOM) continues to conduct its own studies within guidelines set forth by the NRC Governing Board.

In addition to the report of the President, this annual report describes selected completed studies, international activities, the activities of the IOM, and those of the NRC assemblies and commissions.

The appendixes to the report contain the organization and bylaws, membership, and meetings of the two academies, the organization and membership of the Institute of Medicine, the articles of organization of the National Research Council, the Treasurer's report, and a selected bibliography of publications.

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George S. Hammond, *Foreign Secretary*
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NATIONAL ACADEMY OF ENGINEERING

July 1, 1975

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Robert C. Gunness
Frederic A. L. Holloway
Ralph Landau
W. Deming Lewis
Joseph M. Pettit
Morris Tanenbaum

Philip Handler, *ex officio* [1]

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[1] Not a member of the Academy.

OFFICERS AND COUNCIL
INSTITUTE OF MEDICINE

January 1, 1976

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Roger J. Bulger, *Executive Officer*[2]

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Morris Tanenbaum

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[2] Resigned January 31, 1976; Karl D. Yordy was named Acting Executive Officer on February 1, 1976.

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NATIONAL RESEARCH COUNCIL

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GORDON G. F. MACDONALD, *Commission on Natural Resources*
HARVEY BROOKS, *Commission on Sociotechnical Systems*

REPORT OF THE PRESIDENT

To the Academy

April 27, 1976

The life of the Academy since last we met has been extraordinarily busy and complex. There is more to report than time permits.

First, how goes science on the Washington scene?

The National Science Foundation has survived its annual authorization process. Their staff morale has been battered but it should still be intact. Indeed, on a longer time scale, the episode generated by the concerns of some members of Congress with the content of "Man a Course of Study" should leave the Foundation stronger, not weaker. A thoughtful interpretation of the cultural and religious origins of the opposition to the content of MACOS and to the teaching of biological evolution is provided by Dorothy Nelkin in the latest issue of *Scientific American*. She also offers an interesting analysis of conflicts that can arise in our society in consequence of the different attitudes held by those educated in science and those who are not. Some paragraphs seem particularly cogent:

> Concepts of pluralism, of equity and of participatory democracy, as they are defined in the political context, are incongruous in science. Scientific concepts are taught when they are generally accepted by the scientific community. In fact it is precisely that acceptance by the scientific community that acts to validate one concept and reject another. Acceptance by those outside the scientific community is irrelevant. Moreover although science is an open system in terms of social class, the reputation of a scientist depends on his achievements and their rigorous evaluation by his peers. Indeed the internal standards of science may run counter to egalitarian principles. Hence, scientists are particularly distressed by the proposal that laymen participate in defining the nature of an appropriate education in science.

That is not an argument against public participation in decisions concerning the educational materials to be used in the public school system; it merely illuminates the difficulty as seen from one side. But the same argument explains why scientists may also be distressed by a proposal that laymen participate in interpreting the outcome of scientific studies.

A by-product of these activities at the Science Foundation was their stimulus to the examination of the peer review system conducted in hearings by the House Committee on Science and Technology. The resultant evaluative report by that House Committee is unusually well done. Reconsideration of the peer review process will continue at the National Science Foundation for some time while a Committee on Science and Public Policy-sponsored study of peer review is making good progress.

However, the impulse among some members of the Congress to act as the national analog of a local school board seems irresistible. I cannot feel comfortable with the recent action of the House specifically ordering the Department of Health, Education, and Welfare to withhold funds from a much publicized study at Southern Illinois University of the effects of marijuana on human sexual behavior. The bad precedent far outweighs any consideration of the ethics or scientific merits of that study.

This week both houses of Congress will consider identical bills which would place in the White House an Office of Science and Technology Policy. It had been thought that a single bill would emerge from a joint Conference before the Easter recess, and I had prepared an invitation to President Ford to sign that bill before you, here, today. But, although the Conference has reached agreement on a bill, it has not been voted on; hence, no bill has yet been sent to the President. That should surely happen in the next few days.

The OTA is beginning to develop momentum. Currently being formed is a particularly interesting set of panels: one on The Health of the Scientific and Technical Enterprise is to be chaired by Harvey Brooks; that on Applications of Science and Technology by Lewis Branscomb; and on Decision Making on R&D Policies and Priorities by Ed Wenk. Their reports should be very interesting.

It is still early in the process of Congressional appropriations to the various federal agencies for FY 1977. The President's budget is not ungenerous concerning the place of research and development in federal programming. To be sure, the proposed large increase in total federal R&D is heavily weighted by the increment planned for applied research and development in the Defense Department. Still, the President's budget request for R&D offers strong support for the nation's scientific endeavor. The 11 percent increase proposed for basic research and, in particular, the large increase proposed for the basic research program of NSF are most welcome as is a discernible trend toward restoring balance in the research budget of the National Institutes of Health which had been distorted in recent years by excessive relative emphasis on cancer research. Unfortunately, one now senses increasing pressures for "directed" research at NIH and for the biomedical equivalent of applied research as compared to the relative emphasis on untrammeled fundamental biomedical research that has been so spectacularly successful for the past two decades. I hope that these pressures can be resisted.

In passing, we should pay tribute to the orderly manner in which NIH is going about the task of developing guidelines for research on recombinant DNAs. I am also proud of the responsible behavior of our own committee in the early phase of this history.

The Space Agency budget is now dominated by the preparations for the shuttle. There was disappointment when the budget proposal for fiscal year 1977 failed to provide for the first phase of creating a Large Space Telescope. We formally protested and there is a possibility that this situation may yet be rectified, at least in part. Meanwhile the scientific community must propose all the other arrangements for its operation and use in the best interests of science. Plans for a study addressed to that end are now being drawn in the Assembly of Mathematical and Physical Sciences and COSPUP.

As anticipated, the appropriation proposed for ERDA received a strong boost for fiscal year 1977. Regrettably, that budget also continued a previous trend for reduced support of nuclear structure physics, a field which has come upon relatively hard times. We have made known to the government our concern for the welfare of this field, also, and indicated the need for sufficient financial support.

Perhaps under constraints imposed by OMB, ERDA decided not to accept the principal recommendations of our committee with respect to the design of a Solar Energy Research Institute. Our committee described a broad-gauged, powerful and relatively independent institute designed to address diverse facets of the challenge to exploit the immense flux of solar energy. With relatively generous support and a broad hunting license, this laboratory was intended to report to the very topmost levels of ERDA management. However, that agency has apparently decided to implement a much narrower construct that will report to its Office of Solar Energy Studies. Pity!

The budget of the United States Geological Survey will again remain level in constant dollars according to the President's budget. But the proposed budget for the Geological Division—the scientific core of the Survey—has been seriously reduced. The sum involved is quite small and one may surely hope that this error will be rectified in time.

The appropriation proposed for the Department of Agriculture gives little indication of implementing the two reports that we submitted last year as the Interim Report on the World Food and Nutrition Study—except for a small increase in fundamental research to enhance production efficiency. Still at issue are the need for a substantial increase in support of basic research by USDA and commitment to an extramural research grants program in addition to Hatch Act funding.

Nor is there evidence in the budget of a national research program addressed to climate and climatic change—despite a major NRC report that recommended such, a letter in this regard to the Vice President from the Academy, and a report of the Domestic Council that proposed a United States climate research program with substantial and sustained funding. However, there appears to be continuing concern for the nature, scope and the magnitude of EPA's support of environmental research. Research activity has been slowly declining in that agency, despite ever graver need for better scientific data to support environmental decision making. This trend will be offset, in some part, by a substantial increase in the environmentally related research supported by ERDA. The problem of research at EPA seems not merely to be money.

In general, appropriations for research in the social and behavioral sciences appear to be in a steady but no-growth situation. This may, in turn, reflect lack of confidence on the part of the Executive Branch with respect to applied social R&D.

These specific problems concerning the budget proposed for the federally supported R&D enterprise in fiscal year 1977 are real and serious. And the 11 percent increase proposed for fundamental research is insufficient to restore the effective level of research funding to its previous levels. But this should be appreciated in the context of the now very large, overall federal program of research and development. As that treasure trove of information, Science Indicators, has begun to document, the totality of American science is an extraordinarily successful, vital, and self-renewing enterprise in which our country may justifiably take pride. My objective in reporting to you is to help make sure that that pride goeth not before a fall.

That issue of Science Indicators also notes that public esteem of science and scientists remains extremely high. This seems in keeping with the turnaround in first-year graduate enrollments in the sciences which increased last fall over the previous year in almost all scientific disciplines. This cheer would prove to be false comfort if some of our expressed concerns for the full employment of scientists are borne out. But for the moment, I am aware of no serious unemployment of qualified scientists; and the improving economy may compensate, for some time, for the contraction of the system of higher education.

One new undertaking recently proposed to the Commission on Human Resources/NRC is of interest in this regard, namely to conduct a national comparative evaluation of graduate departments, successor to the Cartter and Roose-Anderson reports. As you may know, the State University system of New York has been engaging in a comparative examination of its graduate departments, probably a landmark in the history of higher education. But its implementation is intended to be the closing down of those graduate departments judged to be least productive or qualified. A wave of such actions in institutions across the country may be in the educational interest of future graduate students, and financially salutary from the standpoint of university systems. But it would also contract future employment opportunities. Hence, my mixed feelings.

Well, then, how goes the Academy? I am happy to report that Judge Sirica rejected the argument that the Academy should be treated as "an agency of the Federal Government within the meaning and intent of the

Federal Advisory Committee Act" and found in our favor. The decision was appealed and pleadings before the United States Court of Appeals for this Circuit were conducted just a few weeks ago. I will not tempt fate by attempting to predict the outcome.

The review of the NRC at the Annual Meeting, last year, formed the basis for preparation of the first number of a new documentary series, the Annual Report of the National Research Council. This rather handsome and informative document will shortly reach you in the mail. A fair depiction of the scope and diversity of NRC programs, we propose to give it rather wide general distribution. You may take an extra one home if you wish and let us know if there is someone you wish to receive a copy.

Such mail as we receive concerning the rather sporadic Letter to Members suggests that those Letters have contained more details of newly approved study projects of the National Research Council than you really cared to know. Accordingly, henceforth, the Letters will be limited to selected items which are judged to be of particular interest to you. Your thoughts in this regard will be most welcome.

The restructured NRC is now fully functional. The Executive Committees of the Assemblies and Commissions are populated largely with members of the Academy who now govern the affairs of each of these units. This has freed the Governing Board of the NRC of the necessity for approval of each individual study project. Instead, that Board has begun to acquire a better grasp of the size and mix of programs of each of the Assemblies and Commissions and to appreciate the thrust of the total NRC so as better to plan its future.

As this new management takes hold—and that also includes almost a full complement of new topmost staff for the Assemblies and Commissions—a distinct effort is being made to upgrade weaker program elements albeit with actual elimination of very few. Almost every one of the Assemblies and Commissions is presently engaged in at least one relatively large multidisciplinary study. These include: in the Assembly of Life Sciences—Quality of research of staff and of health care in the V.A.; Assembly of Engineering—The future of nuclear energy in the context of other energy sources; Commission on International Relations—World food and nutrition; Commission on Natural Resources—Environmental decision making; Commission on Human Resources—Requirements for biomedical research manpower.

Each such effort engages dozens or hundreds of committee and panel members, each involves analysis, synthesis and then formulation of conclusions and recommendations in a societal context. In these cases, the NRC has moved from narrow technical questions for which one could expect concrete, specific answers to broad societal questions that may not really have answers, in the same sense, but which are closer to the mainstream of societal consciousness, and political consequence. Managing these complex studies is still a learning experience but we are pleased that, in each instance, the institution has been given the opportunity to address an entire major question, rather than an isolated fragment thereof, as for example, the question of a few years ago, "Can the automobile industry meet the mandated standards for automobile emissions?"

In addition to those I have already mentioned, other Congressionally authorized studies currently underway within NRC are:

(1) A comprehensive study and assessment by the Institute of Medicine of the quality of health care.

(2) A review by the Assembly of Engineering of the scientific basis upon which conclusions are reached by the Department of the Army in the investigation and study of the future water resources needs of the Washington Metropolitan Area and the pilot project for treatment of water from the Potomac estuary.

(3) A study to assist EPA in determining maximum permissible contaminant levels in water delivered to any user of a public water system is required by the Safe Drinking Water Act of 1974.

(4) The just completed studies by the Institute of Medicine to provide a basis for establishing equitable methods of reimbursement for physicians' service in teaching hospitals and assessment of how federal support funds are being utilized in teaching hospitals.

A number of measures under consideration in the 2nd Session of this 94th Congress, if enacted, would authorize additional studies to be carried out by the NRC. Among the more significant and most likely of these studies are:

(1) Continuation of studies of the effects on public health and welfare of vehicle emissions and the technological feasibility of meeting statutory emission standards.

(2) A study of the effectiveness of state implementation plans for reducing mobile source-related air pollutants and in maintaining national primary ambient air quality for such pollutants.

(3) An assessment of suspended particulate matter in the atmosphere, its hazards to the public health, and the availability of control technology.

(4) A comprehensive study of the cumulative effects of all substances, practices, processes and activities which may affect the composition or behavior of the stratosphere.

(5) Review of Alaskan coal mining conditions as well as a study of current and developing technology for surface and open pit mining and reclamation for minerals other than coal.

(6) (a) An analysis of the distribution of physicians, the time they spend in providing care related to their specialty, the projected distribution of physicians by specialty through 1990, and evaluation of various methodologies for estimating optimal distribution of physician by specialty; and (b) a study concerned with various classifications of allied health personnel

and related training programs and costs, classification and needed training programs for correcting such shortage.

(7) A study of the adequacy of existing safety regulations and technology, equipment and technique for operation in the Outer Continental Shelf.

If indeed, some fraction of these bills becomes legislation, the NRC will be very heavily engaged with aspects of the major problems of our time: food, energy, natural resources, the environment, and health. The classic role of the NRC in assisting science itself continues by means as diverse as the Space Science Board, the advisory panels to the Bureau of Standards, and the panels that select the recipients of NSF fellowships, while such diverse committees as those on Prosthetics Research and Development, Tunneling Technology, Food Protection, Naval Studies, and Building Research, etc., continue to make their specailized contributions to the common weal.

Whereas, in general, authorization by the Congress of studies on broad topics of national significance is indeed welcome, the balanced nature of the NRC program is not dependent upon this process. Each major unit has begun to compare its program with an ideal program in its area of responsibility. Each has begun to plan and seek funds for projects addressed to subjects that appear particularly significant but concerning which no request has come from the government. We will soon have ample opportunity to see how well we have rebuilt the NRC.

The procedures developed over the course of several years for control of the quality of study projects now stand us in good stead. The executive committees of the Assemblies and Commissions have become quite discriminating with respect to project approval. The committee member selection process has been working reasonably well; of late, it has detected a handful of instances wherein individuals with a meaningful conflict of interest had been offered committee appointment. Each was rectified. This experience further heightens awareness of this problem so that such instances will be even more rare, henceforth.

I suspect that the Report Review System may work even better than our Vice President knows. All reports are reviewed; his special Report Review Committee oversees the total activity and helps to arrange ad hoc review panels for perhaps 15 percent of all reports; the remainder are reviewed by the procedures of the originating Assemblies and Commissions. And the very fact of the existence of the system goes a long way to assure report quality.

Our principal type of reviewing problem arises with respect to large reports undertaken within a tight deadline. In the typical scenario the deadline is fast approaching as the reviewers confront some seriously troubling aspect that, in their eyes, renders the report unsuitable for public release. Only great good will and cooperativeness have, so far, prevented such situations from becoming big blow-ups. I suppose that there will come a day.

The rules adopted last fall concerning public access to the report process go a long way in the spirit of the Federal Advisory Committee Act. Our subcommittees have now conducted more than a dozen preliminary open public hearings to take testimony from all who care to offer it. This time-consuming process has, as yet, returned little by way of factual information or ideas previously unknown to our committees. But the process has given acceptable evidence of the bona fides of our committees and thus seems decidedly worth the effort.

Unfortunately, the sum of these various procedures has significantly lengthened an already overlong process that is paced by the efforts of unpaid volunteers. And in those cases in which the officials of the sponsoring federal agency feel under pressure to take some action, they have little patience with the niceties of our procedures, e.g., all the agencies concerned with whether the freons of spray cans will cause reduction in the stratospheric ozone concentration. They simply want a report as soon as possible. We have not capitulated, believing the time required to be well worth it. It remains to be seen whether, in the future, this lengthening of the time required to produce a report, as well as the formal, arm's-length nature of the relationship that has been established with most government agencies will have so deterring an effect as to cause unenlightened officials to seek elsewhere for advisory assistance. I don't think that has happened yet.

There are occasional demonstrations of confusion concerning the nature and role of the Academy as an institution in our society. For example, at a recent Academy Forum, I was moved to speak against the proposal that we should regularly solicit nominations for committee members from public interest organizations such as consumer groups, environmentalist groups, etc., so that their institutional views would be represented within NRC study committees. In rebuttal, I noted that the Academy membership is an elite and that among our principal assets in managing the NRC is the ability to distinguish good science from poor science, to be aware of those scientists, engineers, research physicians, etc., who are most productive and to know whose technical judgments we respect. I suggest that participatory democracy is ill-suited to serve as a mechanism for establishing valid scientific judgments. The comments from some of you, commending this posture, are heartening and I shall continue to defend it unless you instruct me otherwise.

Inherent in that position is the notion that a committee of competent scientists, investigating a technical subject of societal significance, can isolate the technical facts from their societal milieu and render a scientific verdict unfreighted by value judgments. When the question is sufficiently narrow, that is surely the case; indeed, the more technical the question, the easier the task. When the question is broad, e.g., what about nuclear energy? and the committee is asked to proceed from its technical findings to discuss societal options, then it becomes important: (a) That the committee visibly set forth its technical findings in value-free fashion; and (b) that the committee be appropriately constructed to engender confidence in its consideration of societal values. It is not clear that our traditional procedures are fully adequate to this challenge. And it is for this reason that we may embark on an experimental study of how to improve our procedures.

Meanwhile, you should not think that we are on a course of unending growth of the volume of NRC business. Rather the contrary. In the current year the dollar volume of NRC studies is about 90 percent that of last year and next year it will not be much larger. This decline entails a reduction in the fraction of all work which consists of activities that go on year after year, e.g., departure of the Committee on International Exchange of Scholars (the Fulbright-Hays program) to a new administrative home. In turn, that means that the character of the NRC is even more that of a "job shop" with its work largely that of ad hoc committees appointed for the life of ad hoc projects, a future of fluctuating workloads. For the management of an organization financed almost exclusively by the indirect cost payments associated with the direct costs of these ad hoc projects, that means a precarious if exciting existence.

Classified studies remain a small fraction of the total although the unclassified activity sponsored by the Defense Department has been increasing lately. We have only one continuing relationship wherein we foster activity concerned with arms limitations or disarmament, cosponsorship with the American Academy of Arts and Sciences of the American Committee for the Pugwash movement. I remain pleased that we assumed this role although the future significance of the Pugwash movement is unclear. We made one major attempt to be of assistance to the ACDA, the study of Long-Term Worldwide Effects of Multiple Nuclear Weapons by a committee chaired by Alfred Nier and released last fall. It was a good job, well done. But the report assumed that everyone knows how utterly awful are the immediate effects of nuclear explosions and how monstrous is the thought of using them, thereby permitting the authoring committee simply to address its charge, which it did in a matter-of-fact manner. I recognized that the spare style of their report might be a difficulty and attempted to ameliorate that difficulty in a letter of transmittal. Unhappily, I may have made matters worse, if anything. And the early press accounts were unforgiving. Later reviews and abstracts grasped the actual message of the report: (a) There are huge uncertainties in projecting the effects of multiple detonations of nuclear weapons; and (b) use of nuclear weapons is even worse than we thought; if enough such weapons are detonated, anywhere on the planet, there will be no place to hide from the resulting worldwide fierce flux of ultraviolet radiation. But that message was garbled in the early public accounts.

We have had considerable attention in the press this year. It began with the Boffey book, of which the less said the better, and continued with a "trial by book review" with the reviews written not infrequently by persons happy to throw stones at "The Establishment" and willing to accept as fact all allegations and assertions in that book. Among these was a harsh account by a member of the news staff of *Science* who is a close personal friend of the book's author. My difficulty about the News and Views section of *Science* is deciding which is which.

A grave disservice to the Academy was performed by *Science* in a story that accused our committee on the prospects of nuclear energy, cochaired by Harvey Brooks and Edward Ginzton, of a strong bias in favor of nuclear energy. The truth is that an extraordinary and successful effort had been made to construct a balanced committee containing persons with all the required competences, from a proper mix of institutional employers, and with a reasonable balance of preconceived opinions concerning nuclear energy. From what I have seen of it, if that committee is unbalanced at all, it is in the direction directly opposite that stated in *Science*. It is difficult to forgive the mischief loosed by an irresponsible reporter concerning a study that had barely commenced and which is of such importance to the nation.

On the other hand, during the year there were innumerable news stories that addressed the content of one or another report in such manner as to indicate confidence in the validity of the report and in the integrity of the NAS/NRC. Among the reports that captured favorable public attention, we may note those on Gas and Oil Reserves, Mining on the Outer Continental Shelf, Pest Control, Genetic Screening, Management of R&D at EPA, Policy Implications of Earthquake Prediction, the Asilomar Conference on Recombinant DNA, the Jojoba Bean, the Winged Bean, the flammability of the seat coverings in the new Washington Metro, and the two reports on the world food situation. There was also much favorable comment on our open public hearings, and on our comments on the "peer review system." All in all, our press scrapbook reveals that it has been a good year. Occasionally there was egg on our face. But if we engage in studies of immediate socioeconomic or political significance, from time to time, others will surely find fault.

Some notes about international matters. Our new baby in Vienna, the International Institute for Applied Systems Analysis (IIASA), appears to be gathering momentum and the confidence of a broader segment of the scientific population. It is a genuine multinational lab where scientists of diverse disciplines and nationalities live and work together, sharing information and responsibility, and engaging significant problems. While it is undoubtedly too soon to make a formal evaluation, the baby seems very healthy. It is gratifying to be able to tell you that our colleague, Tjalling Koopmans, has conveyed to the Academy a substantial share of his Nobel Prize to be utilized for the support of IIASA.

We've now had a year of experience with the Radiation Effects Research Foundation, the joint Japanese-American successor to the Atomic Bomb Casualty Commission. All one can yet say is that the Japanese have indeed accepted their responsibilities for this enterprise. There is a major bureaucratic obstacle to their success: finding a way for an institution funded by the Ministry of Health to bring into its laboratories scientists working in the Ministry of Education. It will be interesting to observe their progress. Our own role is now somewhat less responsible than before—but our task is decidedly more subtle.

Our exchange programs with the Soviet Union and the other communist countries of Eastern Europe have been the subject of some difficulty. The Academies of those nations have indicated their strong desire to expand the level of these exchanges, viz., to increase the number of man-months per year available on each side. But we cannot, since the line item in the budget of NSF from which these funds are derived has not been increased in several years. Indeed, since it has been necessary to increase the cost of living allowances to compensate for the inflation, we have informed the East European Academies that there will have to be a decrease in the number of exchange man-months per year in each direction. Ironically, since the actual sums involved are so modest, this information will probably be interpreted as deliberate implementation of a formulated political policy when, to my knowledge, the circumstance reflects only fiscal, not political conservatism.

There are, of course, those who suggest that the Academy cease to engage in such exchange activities so as to make clear to the Soviet Government the gravity of our displeasure with diverse violations of the human rights of scientists in that country. And we have seriously discussed the wisdom of such a course. Indeed, the question of the role of this institution with respect to violations of human rights in other nations has been much on our minds.

The Academy has received diverse requests to remonstrate with Soviet officials concerning the plight of scientists who have lost their positions after indicating their desire to emigrate, of scientists who have lost some or all of their professional status, apparently for having engaged in the human rights movement, of scientists who have been exiled, jailed, or otherwise incarcerated for having been more outspoken than others concerning such matters. We have heard from Sakharov on behalf of various colleagues, from Levich on behalf of Sakharov, and, most recently, from Levich in despair for his own future. Copies of the latter are available at the door for all who are interested and will be mailed to any member so requesting.

We have heard from others concerning physical abuse of scientists and other intellectuals in Chile and Argentina and elsewhere in South America. We sadly watch the disappearance of democratic or almost democratic governments; we wonder at the soundlessness of the imposition of repression in

India. And the Council, the Foreign Secretary, and I agonize over each episode.

We have observed the circulation of petitions that went to the Soviet Union on our stationery, and of petitions sent on FAS stationery but signed only by members of the Academy. We have been congratulated for our seemingly successful defense of Sakharov and we have been criticized for not having done much more for many others and been more publicly visible when we do so.

Patently, the Academy must learn its own mind in these matters, must decide whether it has a responsibility or obligation to speak to violations of the human rights of scientists or other intellectuals wherever these may occur, must determine whether our exchange programs with Communist countries or programs of technical assistance to developing countries are leverage in discussions with the officialdom of such nations.

My own beliefs are simple. I consider that the fabric of intellectual freedom, including the freedom of inquiry, is one with the fabric of human rights as these are asserted in the Bill of Rights in our Constitution and particularly in the 1946 U.N. Universal Declaration of Human Rights. It is a single tissue, a web that cannot be rent anywhere without being damaged everywhere. It cannot safely be torn in some corner of the globe—a courtroom in Lithuania, a psychiatric institution at Serbsky, a closed printing press in Bangalore, a concentration camp in Auschwitz, a redlined fashionable Northeastern suburb, or a flaming cross on a Mississippi hill—without damaging each of us and endangering the future of our species.

I am committed to defense of the human rights of all persons, and those of scientists in particular. Not, as is so often argued, because humanity may be denied the fruits of their science but because they are precious as human beings, because abrogation of their rights is injurious to all mankind, because, as liberal intellectuals, scientists not infrequently become involved in the defense of human rights of others and because I am likely to be best informed concerning their circumstances. And I believe that the Academy has a very special but limited role to play in this never ending effort.

The fact that the Academy is responsible for maintaining communications with the scientific communities of other countries by diverse means—exchange programs, participation in international unions, scientific congresses, etc., as well as various mutual cooperative ventures—is both a principal means of leverage and a limitation on our behavior. Protest may take any form short of disruption or termination of such communication vehicles. And our displeasure has been made known rather frequently, usually by face to face communication with an official or a well placed scientist of the country in question. In recent years that has usually meant the Soviet Union to which we have sent a wave of protest. Such protest is usually a statement of moral indignation; warnings, veiled or explicit, to interrupt the flow of communication or exchange, such as that embodied in our statement defending Sakharov, may be expected to be very effective, yet can only be employed rather seldom. And a continuum of protest on behalf of every scientist whose rights have been violated can easily saturate the receptor mechanisms.

It is for these reasons that I have encouraged our Foreign Secretary to address these difficult matters. And for these reasons I associate myself with the proposals that he will, shortly, place before you.

Finally, may I use this opportunity to express my deep appreciation for the sheer human good will that is so lavishly heaped upon this institution. Here, thousands of the country's very best brains labor in the public vineyards for little reward but the joy of giving that which only they can give—as committee members, as committee chairmen, as the Council, and as your officers. For their generosity with themselves, our country should be most grateful. I am.

Thank you.

PART I: SELECTED COMPLETED STUDIES

WORLD FOOD AND NUTRITION STUDY

Despite increases in worldwide food production brought about by the so-called "Green Revolution," heavy application of fertilizers, and improved agricultural management practices, there is concern that the projected world supply of food may not keep pace with the projected growth in world population. An additional 25 million tons of grain must be produced each year just to feed the current annual increment in world population. Complicating the need for increased agricultural productivity is the need for increasing production with the lowest possible inputs of nonrenewable resources in land, water, energy, and fertilizer, and with minimum deleterious environmental impact.

The FAO estimated for the World Food Conference, held in Rome in November 1974, that there are at least 460 million malnourished people in the developing world. The Conference and related events stimulated, on the part of the peoples and leaders of the world, an unprecedented awareness of the nature of current and future world food problems and an unprecedented willingness to act on them.

In December 1974, President Ford asked the Academy's aid in a "major effort to lessen the grim prospect that future generations of peoples around the world will be confronted with chronic shortages of food and with the debilitating effects of malnutrition." The two-year World Food and Nutrition Study was undertaken by the Academy in June 1975. A World Food and Nutrition Study Steering Committee was established in the NRC Commission on International Relations.

In November 1975, NAS President Handler transmitted to President Ford two study reports, *Enhancement of Food Production for the United States*, prepared by the Board on Agriculture and Renewable Resources, and *World Food and Nutrition Study: Interim Report*, by the Steering Committee. Attached to the *Interim Report* is a special statement, *Recommended Actions on Nutrition Research and Development*, prepared under the auspices of the Food and Nutrition Board.

ENHANCEMENT OF FOOD PRODUCTION FOR THE UNITED STATES

North America—particularly the United States—has become the principal source of food supplies for most of the world, exporting millions of tons of grain each year to Europe, the Middle East, Africa, Asia, and Latin America.

Recognizing that the world will continue to need and welcome all the food that the United States can produce for export, the Board on Agriculture and Renewable Resources prepared the report, *Enhancement of Food Production for the United States,* which provides detailed findings and recommendations concerning research priorities for improving and increasing production by American agriculture, thereby enlarging the world's food supply. As the report points out, however, the recommended research and development can only buy time until the expansion of population comes at least partially under control.

The report is composed of two parts. Part One contains conclusions and recommendations that point up some of the deficiencies in current U.S. investments in agricultural and food research. Part Two stresses the U.S. needs for an assessment of land, water, and manpower resources, and for research on human nutrition, energy, weather, crops and livestock protection, fertilizer, the production of crops and livestock, and biological processes that control or limit productivity.

There is an urgent need, the Board said, for an improved institutional framework for reporting, observing, and managing the wide range of U.S. research activities related to food. It suggested that a "National Agricultural Research Policy Research Council representing the many federal and state agencies responsible for agriculture and agriculturally related research be established" to set national agricultural policies and goals.

The report lists several recommendations regarding the funding and management of agricultural research, more effective distribution of scientific and technological information that could have a significant effect on food production, the expansion of improved weather information services to include national coverage, professional education needs with respect to the technological aspects of food production, and contributions from the social sciences appropriate to the solution of food production problems.

Specific research recommendations focus on crop and livestock production and on the dependability of the food supply, the resources necessary to achieve that productivity and dependability, and the requisite processing and storage technologies to insure that food will reach those in need. "Because of crop surpluses, political pressures from commodity groups, budgetary reductions, and emphasis on immediately applicable results," the Board said, "a formerly substantial research effort in the Agricultural Research Service (ARS) and the SAES [State Agricultural Experiment Stations] virtually disappeared. Consequently, the agricultural research system now faces inadequacies in fundamental knowledge about photosynthesis, nitrogen fixation, crop and livestock protection, water and nutrient efficienceis, genetics, and plant-soil-water relationships."

Although the primary focus of this report is on recommendations for agricultural, food, and nutrition research that, if implemented, would enhance the production and stability of the food supply in the United States, it contains observations, also, about the solution of food problems abroad. As the report points out, "the U.S. and other developed countries cannot produce and export more than a small fraction of the food required now and in the future by the burgeoning populations of agriculturally developing nations."

The agricultural research programs that have been established in most of the developing countries are often inadequately supported and staffed and lack modern facilities. The Board concluded that such nations could be helped in developing their capacity for technological innovation and management by collaboration with experienced agricultural scientists from other countries. It suggested that the U.S. should function as a part of the international technical assistance groups from various developed countries, foundations, and international research centers. The Board recommended that the many and diverse existing U.S. assistance programs should be coordinated under a single strategy or long-term plan of action for increasing world food production or providing technical assistance in technology innovation.

Many of the constraints upon agricultural productivity in developing countries have been well recognized and discussed; for example, arbitrary pricing policies for inputs and outputs, inadequate credit and marketing institutions, lack of modern inputs, poorly functioning teaching, research, and extension institutions, and inequitable and impractical land tenure arrangements. On the other hand. the increasing chain of constraints that bear directly or indirectly on the technological opportunities for expanding U.S. agricultural production are less well understood. The Board recommended a comprehensive analysis of the cumulative effect and total cost of federal regulations and legislation on U.S. agricultural research and production. Among them the Board cited measures that are being taken to control air and water pollution, waste disposal, chemical residues, and genetic variation; to protect endangered species; to zone land for agricultural use; to restrict the development and use of water resources for agriculture; and to regulate the use of agricultural labor.

WORLD FOOD AND NUTRITION STUDY: INTERIM REPORT

According to the Steering Committee's report, the United States, with its resources and broad technical capabilities, can play a pivotal role in international collaborative efforts to avert hunger for future generations around the world. For such efforts to succeed, however, will require each country to establish policies and institutions that encourage the use of technological improvements. "The most important ingredient," the Committee said, "both in the United States and in other countries, is the political will to do what is needed and feasible."

Although improved storage and distribution of food within each country and throughout the world, coupled with an improvement in the quality of existing diets, could do much to alleviate the most serious current problems of malnutrition, unless world population is brought under control, the needs of future generations can only be met by a sustained trend of very substantial increases in agricultural yields in both the developing countries and the developed countries, particularly in the United States. The Committee recommended that the government launch a study in the population field, comparable to the World Food and Nutrition Study, to see how U.S. research capabilities could best be mobilized to help all countries that wish to find better means of coping with population problems.

The Committee identified three types of actions to improve the impact of U.S. research and development on world food problems, each of which, it believed, should be pursued without delay: fuller participation by U.S. research institutions and scientists in international research and development systems; strengthening of several lines of research in the United States that have worldwide importance as well as major importance here; and establishment of more effective mechanisms for strategic consideration and harmonization of U.S. policies and programs concerning food and nutrition, including the research components.

International Research and Development Systems

The Committee recommended redoubled U.S. efforts to help build collaborative associations or networks of R&D organizations throughout the world that work on a common set of problems. "A good start has been made," the Committee said, "in establishing international R&D networks, but there is much more than could and should be done, starting right away." Specifically, the Committee urged the following steps: (1) The United States should mobilize more of its research capabilities and supporting finance to help strengthen existing and new international R&D networks that address high-priority global problems, i.e., developing country research establishments, international research centers, and supporting U.S. research activities, as well as the linkages among them. (2) The United States should establish, sustain, and make strong use of legislative authority, such as the proposed Title XII of the Foreign Assistance Act, and of appropriate research budgets throughout the government to provide continuity of support at rising levels of multiple forms of U.S. research involvement on problems of world food supply and nutrition. (3) The United States (USDA and AID) should establish a specific clearinghouse and financing mechanism to facilitate individual American initiatives or responses to overseas initiatives that would link U.S. research activities with those of international R&D networks. (4) The United States (USDA and NSF) should institute a program of extramural grants to draw a wider range of the best U.S.

scientists into research on food and nutrition problems, combining individual scientific initiatives within a mosaic of activities furthering broad program goals.

Research Priorities

High priority should be given to research in the following areas, the Committee said: (1) Increasing the amount of biological nitrogen fixation in major food plants and in the soil; (2) increasing the rate at which the major food plants synthesize carbohydrates and convert them to foodstuffs; (3) widening the potential for genetic or other biologic improvement in plants by development and application of new techniques of cell and tissue culture and DNA recombinations; (4) increasing the effectiveness and lowering the costs of chemical fertilizers, particularly to widen use by the mass of poor farmers in the tropics; (5) reducing food losses caused by pests by strengthening the tools used to combat pests and devising better combinations of these tools to apply to the great variety of farming and postharvest situations around the world; (6) increasing production of livestock products, particularly from cattle, by improving forages for the predominant worldwide types of range land, suppressing major diseases of tropical livestock, and increasing livestock reproductive efficiency; and (7) increasing, through genetic changes, the protein value to humans and animals of the principal grains consumed worldwide.

All of these areas offer prospects of large gains worldwide, as well as in the United States, if research breakthroughs are achieved, the Committee said, adding, "It is also clear that there are a number of high priority research areas offering prospects of major dividends from adaptations or extensions of known technology, and that such prospects are likely to be realized earlier than results dependent on scientific breakthroughs." In this connection, the Committee cited the need for accelerated work on conventional breeding for higher and more dependable yields; on-farm management of available water in developing countries; development of a variety of intensive cropping systems for the tropics, coupled with readily accessible information systems; development of efficient farming systems that use minimum energy and little or no tillage; and collection and evaluation of worldwide germ plasm.

In nutrition research, the Committee recommended development of low-cost technologies for fortifying mass-consumed foods of developing countries or otherwise supplementing diets to offset critical nutrient deficiencies; development of low-cost techniques suitable for monitoring nutritional status that will provide basic data for national and local planning of nutritional improvement programs in developing countries; and better definition of the extent, nature, and effect of protein deficiencies.

The Committee estimated that, over the next two or three years, an overall increase in the U.S. food and nutrition research budget of at least 50 percent in real terms will be needed to make a strong start on the new priorities.

Food and Nutrition Strategy

The Committee recommended that the United States should establish more effective arrangements to: (1) Strengthen national research and development on world food and nutrition problems; (2) improve the mutual support and collective impact on these problems of the many State and federal, public and private research activities; and (3) improve the integration of these activities with work outside the U.S. It further recommended that the U.S. establish, as part of such arrangements, an effecive mechanism for continuous development and adjustment of U.S. food and nutrition strategy and its research and development components.

What is at Stake

Wise use of this opportunity to accelerate production and improve nutrition, the Committee said, can exert a significant influence in averting hunger for future generations, while maintaining plentiful and low-cost food supplies in the United States and expanding U.S. trade in food as well as in other commodities. The United States would also strengthen its knowledge base about the world and increase the chances for a peaceful and prosperous world of mutual accommodation among sovereign states.

SWEETENERS: ISSUES AND UNCERTAINTIES

"Sweeteners: Issues and Uncertainties" was the topic of the fourth public Forum, held by the National Academy of Sciences in March 1975. More than 50 individuals representing public interest groups, private industry, government regulatory agencies, and the scientific community met for two days to discuss the risks and benefits of both nutritive and nonnutritive sweeteners. The Forum report was published in October 1975.

The first day of the Forum was devoted to a review of perspectives on sweeteners—their biological and cultural role, patterns of use, medical and toxicological issues, and regulation of use. The second day focused on nonnutritive sweeteners, ending with discussions of future options for both natural and artificial sweeteners.

There was almost unanimous agreement that the desire for sweets is a basic biological drive, and that the quality of taste is improved by sweetness. In the past, it was pointed out, sweetness requirements have been met by carbohydrates, but in recent years, there has been a shift from carbohydrates to sugar, a shift from sucrose to other sugars, and a shift from home use to industrial use of sugars. Over the past 65 years, the American diet—particularly the carbohydrate portion of the diet—has moved from a preponderance of polymeric carbohydrates to a preponderance of simple sugars, and individual total sugar consumption has increased from a daily average of 156 grams in the period 1910–1913, to a daily average of 200 grams in 1974. The discretion of the consumer is limited, because most of the foods that contain sweeteners are convenience foods, and the sweeteners in them are chosen by the manufacturers on the basis of function and cost.

The use of sugar in relation to four medical problems—obesity, diabetes, dental caries, and heart disease—was discussed at some length by speakers voicing diverse viewpoints as to the role of sugar versus the use of artificial sweeteners in the prevention or management of these conditions. There was unanimity, however, in the opinion that sucrose is the principal causative agent in dental caries. Dental caries were described as pandemic among American children, who are barraged with television commercials, extolling sugar-coated cereals, sweet soft drinks, and other sweet snack foods. For example, the dollar volume of television advertising for cereals alone during the first six months of 1974 was cited as $8,929,000. Also in connection with cereal products, according to calculated values of the proportion of cereal grain to sugar content in individual commercially marketed cereal products, the cereal content versus sugar content ranged from 99 percent cereal with no sugar, to a low of 33 percent cereal to 47 percent sugar, with an average ratio of approximately half and half. A question was raised as to why sweeteners, either natural or synthetic, should be applied to food products at all since they are not essential nutrients.

The consumer advocates asked for definitive scientific answers about the safety of sweeteners—answers that, according to the scientists present, are extraordinarily difficult to give. In fact, it was pointed out that zero risks in any aspect of life are impossible to achieve. Safety is the level of risk that society has decided to accept.

Better communication between scientists and the public is vitally needed, according to one participant, who bluntly accused the scientists of "talking to yourselves." He pointed out: "The law and society and consumerism and environmentalism and the whole gamut of how we live and what we do is no longer as it once was. If you continue to speak to yourselves . . . then you will find that the voice of science will continue to be heard inadequately in the halls of Congress and in the community."

In the discussion of artificial sweeteners, the consumer advocates were particularly critical of the Academy's report on the safety of saccharin because of its lack of a definitive answer regarding its safety. As one consumer advocate put it, "How can we go on ingesting this material until we have proof of its safety?" It was pointed out by a scientist that toxicity was the chief concern in the saccharin report and that the weight of evidence available to the committee at the time of its study did not permit the committee to condemn saccharin for widespread use. The committee did, however, express some reservations and recommend further research. The discussion of this issue ended in a confrontation, rather than resolution. Consumers and consumer advocates were not satisfied with a conclusion of high probability of safety.

Among other sweeteners discussed was the new product, dipeptide aspartame, which is composed of substances occurring naturally in foods, but which requires specific safeguards in the case of children with the metabolic defect, phenylketonuria. One scientist pointed out that safety test trials conducted on this material had failed to take into account other amino acids being ingested at the same time with possible effects on brain function.

Questions were raised as to the validity of banning cyclamate in the light of new evidence developed in 20 specific carcinogenic and cocarcinogenic studies completed in the years since cyclamate was banned in the United States. On the basis of these studies, cyclamate will be given a new hearing by the Food and Drug Administration in the near future.

It was pointed out that the only excuse for government intervention is a threat to the collective public welfare. The Forum discussions revealed no clear and present danger to the welfare of the people. There should be a balance, it was noted, between the cost of answering sweetener safety questions and the use of limited resources for the solution of other recognized and more demanding health problems.

In his final remarks, Dr. Handler noted the growing public distrust of the introduction of chemicals into our society—a distrust that he believed was warranted. It behooves scientists, as individuals and as members of the scientific community, as well as the government, he said, to assure themselves and everyone that each time a new chemical is introduced, it is both desirable and acceptable.

TECHNOLOGY OF FORTIFICATION OF FOODS

A number of deficiency diseases in the United States have been largely eradicated by the fortification of foodstuffs—B vitamins in enriched cereal products have eliminated beri beri, pellagra, and ariboflavinosis; iodized salt has reduced the incidence of goiter; and rickets has all but disappeared since the introduction of vitamin D into milk some 30 years ago. Most remaining nutrition problems, however, are less well defined than vitamin or mineral deficiencies. The increasingly complex variety of food products and the changing patterns of dietary habits raise questions about the philosophy of nutrient addition to food: Should such additions be based on restoring "normal" levels of nutrients lost in processing individual foods or should they be added on the basis of general health needs without regard to the composition of the original product? The resolution of these questions will depend on the maturity of nutritional sciences and the development of a national nutritional policy, both of which appear to be some time in the future.

Although recent practices in fortification have been evaluated for both efficacy and safety, there has been little consideration of the purely technological difficulties related to the fortification of each individual food, such as the stability of the nutrient to processing, storage, distribution, and preparation; the ability to measure and predict the benefits, lack of benefits, or negative effects of additives; the cost to the manufacturer and to the consumer in relation to the benefits; bioavailability at the time of consumption; and knowledge of how to limit or control nutrients that may cause allergic reactions or that may pose the danger of excessive consumption.

During the year, the National Academy of Sciences released the report, *Technology of Fortification of Foods,* the proceedings of a workshop convened by the Subcommittee on Food Technology of the NRC Committee on Food Protection, Food and Nutrition Board, that brought together specialists who are actively engaged in the technological fortification of foodstuffs. The report considers general problems associated with a variety of product categories, including infant foods, cereal products, milk and milk products, meat and meat products, fruits and vegetables, formulated foods, and beverages, as well as discussions of vitamin fortification technology and the technological problems in fortification with minerals.

According to the report, each category, as well as individual foods within each category, poses problems related to the best in-process point for additions; selection of the proper market forms of additives (pure compound, direct addition tablets, wafers, or cubes, solutions, emulsions, dispersions, or dry premixes); the stability of the additive in relation to its reaction to other additives, the chemical composition, acidity, fat or moisture content of the food itself, processing, storage conditions, shelf-life and final preparation for consumption; and bioavailability of the nutrients in the consumed product.

In the case of vitamins, for example, the report points out that niacin is stable in almost every type of food-processing operation. Vitamin C, on the other hand, is sensitive to oxygen, iron, copper, and anthocyanin pigments. Fortification with vitamin C requires substantial overages above the label claims in almost all applications to insure label claim for the intended shelf life of the product. Riboflavin is stable in most applications, but is extremely light-sensitive and losses can be expected under supermarket meat display conditions. Thiamin has two potential problems—heat lability and odor. Its heat stability is pH-dependent. Fortification with all vitamins requires overages to insure compliance with label claims because of variability in distribution and analytical variation.

Fortification with minerals creates problems of color, flavor, physical body and texture, cost, and control, and the technological problems increase as higher proportions of the Recommended Daily Allowances (RDA) are included per serving of a product, the report says.

The report notes specific instances in which certain nutrients cannot be put into certain products, even though it might be desirable to add them. For example, it is very difficult to put vitamins A and B into cereal products or to get and retain the flavor in fruit juices when vitamin B_1 is added.

Iron salts may be added to cereal, but not to fat products. A great deal of research is needed in this area, the report says. Assays are also needed for vitamin K, folic acid, and even protein efficiency ratio. The interactions that take place between the added nutrients and the food products are not completely understood.

In addition to recomendations for more research on a number of technological problems, the report lists several areas that should receive further attention, including:

1. The potential for nutrient variability due to genetic variation among food sources.

2. Nutrient stability and lability should be considered for specific nutrients under specific, well-defined conditions with specific processes in terms of nutrients, need, and logical alternatives.

3. Further consideration should be given to the final preparation of food for consumption. The total food system should be considered when attempting to evaluate the nutritional significance of processing, preservation, storage, and final preparation for consumption.

4. The toxicological aspects of the degradation products resulting from vitamin breakdown should be investigated. More work is needed on the interactions of both vitamins and minerals at the food-processing level.

5. Better assay methods are needed for nutrient measurements, including protein quality determinations and vitamin and mineral content of processed foods.

6. Regulatory agencies need to recognize that in the future meats may need to be enriched. This may be addition of meat analogs to extend an increasingly short supply, or addition of micronutrients appropriate to this group of foods.

7. Formulated foods provide an excellent opportunity for future innovations that will help meet nutritional needs.

8. In studies designed to maximize nutrient retention, care must be taken to maintain an appropriate balance with other quality attributes. Risks related to microbiological safety of foods must always be minimized, and microbiological safety considerations must take precedence over certain processing changes designed to improve retention of such nutrients as thiamin.

PUBLIC HEALTH: ETHICAL CONSIDERATIONS

EXPERIMENTS AND RESEARCH WITH HUMANS: VALUES IN CONFLICT

From time to time during the past few years, several revelations of real or imagined abuses of human subjects of medical experimentation have been widely publicized by the news media. Among the most appalling have been the Tuskegee syphilis study, the oral contraceptive study in which a control group of Chicano women were not told they were being given placebos, and the introduction of live cancer cells into the bodies of geriatric patients without their knowledge or consent. Although such cases represent only a fraction of a percent of the clinical research performed in the United States, they made a shocking impact on the public and the Congress.

In the hope of bringing about a better understanding that could lead to more adequate procedures for accountability in such research, the Academy organized a two-day public Forum on "Experiments and Research with Humans: Values in Conflict," held in February 1975. This, the third in a series of Academy Forums on controversial or topical issues of public policy, brought together approximately one thousand people for discussion and debate. The participants included physician-scientists, sociologists, ethicists and philosophers, theologians, lawyers, representatives of special interest groups, government officials, and other interested citizens. By and large, two viewpoints were presented—those of medical researchers, who felt that the excesses, while they exist, are in general minimal as compared with the benefits that have resulted from biomedical research; and the nonphysicians who were, in general, aware of the contributions of medical research, but who were concerned about the abrogation of individual rights.

The medical researchers pointed out that the problems of ethics and of accountability have existed since the beginnings of experimental medicine. In therapeutic innovation, for example, whether it be the first trial of a new drug, or of a vaccine, or of a surgical procedure, there must always be a "first," and this is always human experimentation, even though it may be of direct benefit to the person being experimented on. From nontherapeutic research (experimentation in persons not expected to receive any benefit personally) have come some of the greatest advances in medicine—the virtual elimination of smallpox, diptheria, polio, and yellow fever, vaccines for mumps, measles, and other infectious diseases, and successful kidney transplants, to name a few.

There was considerable discussion of fetal research, research on children, and research on captive populations, such as prisoners or institutionalized patients. Each of these categories poses problems in obtaining "informed consent," and some participants felt strongly that none of these should be subjects of research. Some of the widest divergences of opinion were expressed in the discussions and debates about the moral and legal versus the scientific need for fetal research, which was opposed by some as an adjunct to legalized abortion. According to one speaker, ". . . modern medical research, development, and practice are so inextricably linked, especially in the areas of obstetrics and pediatrics encompassed by fetal research, that a deterrent to the human aspect would be immediately translated into reduced medical care for untold numbers of young infants and their mothers. That this possibility could become a reality in a civilized society is unthinkable, truly inexcusable, no matter how important the real or imagined issues might be that allow it to come into being."

With regard to research on children, it was pointed out that children's reactions to drugs differ from those of adults and that excluding them from drug trials, for example, would deprive them of access to new drugs and medical advances.

The arguments for and against the use of prisoner-volunteers or military personnel for medical research were based, on the one hand, on the premise that no man is a free agent in prison or in the armed forces and, accordingly, "consent without coercion is impossible" under those conditions. On the other hand, some participants were not convinced that informed consent cannot be obtained from competent individuals who are institutionalized, and failing to include them would "narrow the range of options available to these individuals by making it impossible for them to volunteer to participate in studies, whatever their motivation." It was pointed out that institutionalized populations are of great value in medical studies because they are stable populations living in controlled environments—a condition that would be impossible to duplicate in a non-institutionalized environment.

In a discussion of regulatory, judicial, and legislative processes to protect the rights of those who take part in research studies as subjects, the Secretary of the Department of Health, Education, and Welfare (HEW) opened the discussion, saying that the Department is trying to develop a set of safeguards, spelled out in guidelines, that will be flexible enough to enable vital medical research to continue, while assuring the public that human rights are indeed being protected.

By Congressional legislation, a National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research has been established in HEW to undertake a number of major studies that will lead to recommendations to the Secretary of HEW and the Congress and to preparation of the agenda for the National Advisory Council for Protection of Subjects of Biomedical and Behavioral Research, which will be the surviving body after the two years of Commission studies have ended.

The effectiveness of the present review mechanism for human experimentation was a matter of much interest. All institutions that conduct research with federal funding are required to have a committee that is responsible for review of all proposed experimentation involving humans and for monitoring the project once it has been approved. Some concern was expressed about the composition of these committees, and most of the participants agreed that, in order to have a proper review of the ethical concerns, the medical researchers should be assisted by nonmedical persons. A question was also raised concerning the degree to which the actions of the committees are made public and the kinds of records that are kept.

It was pointed out that little is known about how satisfactorily and safely the review committee system works, whether they provide total protection against trivial research, research carrying some hazard for the subjects, or research holding no promise of benefit to anyone. The speaker concluded that there is an urgent need for a new study by the Institute of Medicine of the review mechanisms, protective rules, approved criteria, etc., in a meaningful sample of teaching hospitals in this country.

As a result of this Forum, the Institutional Relations Branch of the Division of Research Grants in the National Institutes of Health is using the record of this Forum in 24 of its publications used as research and reference materials for programs involving biomedical experimentation with human subjects.

COAL WORKERS' PNEUMOCONIOSIS—MEDICAL CONSIDERATIONS, SOME SOCIAL IMPLICATIONS

Historically, disasters have been the catalysts for health and safety legislation, but until recently mining disasters have produced much rhetoric and little action. The Bureau of Mines was not established in the Department of the Interior until 1910—about 45 years after the initial legislation to create it was introduced. Federal inspection of coal mines was not authorized until 1941, and even then was not adequately enforced. The record until 1968 was marked by indifference. In that year, a violent mining explosion at Farmington, West Virginia, which took the lives of 78 men, shocked both the public and the Congress and propelled the Congress into rapid and forceful action.

A report by a panel of the NRC Committee on Mineral Resources and the Environment points out that the legislation passed by the Congress—the Federal Coal Mine Health and Safety Act of 1969 (P.L. 91–173)—set an historic precedent. For the first time, "mandatory federal health standards were established including respirable coal mine dust levels in all working sections of the mines. Perhaps most importantly, benefits were awarded to underground coal miners suffering from Coal Workers' Pneumoconiosis (CWP), an occupational disease." Three years after passage of this Act, further legislation, entitled the Black Lung Benefit Act of 1972, was enacted. That Act expanded the definition of total disability, provided that compensation should not be denied solely on the basis of chest X-rays, and established a rebuttable presumption of total disability that was compensable if a miner had been in the mines for 15 years and suffered from a total disabling respiratory impairment. These legislative changes, the panel said, substantially expanded eligibility of miners and their dependents, even to the extent of including disabilities arising from chronic respiratory ailments other than CWP and now grouped under "Black Lung Disease" (BLD)—a legal rather than medical definition. Federal benefits for BLD now exceed $1 billion annually.

The panel's report supports the concept of an equitable Black Lung Benefits Program, but seriously questions the wisdom of basing the program on the unjustified presumption that all chronic respiratory ailments occurring in coal miners are job-related. The report points out that "the administrative complexities of the program, its enormous and rising costs, and the strong possibility that it will set a precedent for other hazardous occupations, make it imperative that the program be based on the accurate definition and disentanglement of medical and social issues."

Three policy options are suggested in the report, including: (1) That benefits be paid directly without requiring a distortion of medical knowledge to justify the benefits. Veteran's benefits were cited as a legislative precedent for rewarding hazardous work. (2) Remove all reference to CWP as the sole disease for which benefits would be paid and substitute definitions and procedures that clarify the specific diseases and diagnostic evidence needed to establish eligibility for benefits. (3) A judgment could be made that, as of a specified date, all miners and ex-miners who suffered impairment and total disability during the years prior to the imposition and enforcement of federal dust standards, along with surviving dependents, would be included in the benefit program, and miners who entered the industry after the dust level standards were met, would receive benefits only for CWP.

If either of the first two suggested options were adopted, the panel said, it would be reasonable to suggest that similar benefits be extended to workers in other hazardous occupations, including, for example, workers in cotton mills, asbestos workers, hard rock miners, coke oven workers and steel workers, all of whom are subject to a variety of occupationally related diseases of the lungs. If benefit programs were extended to workers in other industries, the costs might range from $20 to $100 billion annually, the panel said, and would undoubtedly force new and fundamental decisions on society regarding pension and benefit programs.

A rationale for the third policy option would be that society had attempted to fulfill its indebtedness to those coal workers who had been exposed to years of excessive amounts of coal mine dust. The panel emphasized, however, that it did not intend to imply that the federal government should be chiefly responsible for compensating disabled coal miners as it is at present. Indeed, they said, there is considerable debate over how to distribute this cost and whether it should be managed through public or private agencies. The debate would intensify if other hazardous occupations were to become involved.

NATURAL RESOURCES

RESERVES AND RESOURCES OF URANIUM IN THE UNITED STATES

In order to meet future energy demands in the face of dwindling domestic supplies of oil and natural gas and uncertain supplies for abroad, the United States must choose among several energy options, basing its choice on reliable information about the magnitude and availability of energy from each.

In December 1975, the Committee on Mineral Resources and the Environment released the report, *Reserves and Resources of Uranium in the United States,* one of a series of reports that examines estimates for various critical mineral resources. The data base for the study was derived from studies by the U.S. Geological Survey (USGS), Battelle, the Electric Power Research Institute, and the Atomic Energy Commission, and from information generated at a two-day conference held in December 1974 in Albuquerque, New Mexico.

The purpose of the study is to contribute information on which government decisions on commitment to nuclear power must be based, such as the nature and extent of the uranium reserves and resources in this country and the rates at which uranium can be supplied from them during the next 25 years. The report does not consider the economic, social, and environmental determinants of the future role of nuclear power in the United States although these factors, too, will have a significant influence on governmental decision-making.

According to the report, the distinction between reserves and resources is vitally important. The term, reserves, refers to amounts of uranium deposits that have already been discovered and have been shown by exploration and testing to be of such uranium content, size, and other characteristics that the uranium can be extracted profitably, whereas the term, resources, refers to amounts of uranium estimated to be potentially available. Although firm plans can be made on the basis of reserves, plans based on resources are contingent upon discoveries of hitherto unknown deposits, advances in technology of mineral extraction, or economic changes. Estimates of uranium resources are based partly on concrete data for tonnages and grades and partly on conjecture, and this has led to substantial differences of opinion, the report says, as to whether these resources are adequate to supply the uranium required for uranium-fueled power generation.

The Committee concluded that "At some time after 1980, lacking a breeder reactor, domestic production of uranium from present reserves may begin to fall short of estimated domestic uranium demand." After 1980, they said, domestic uranium supply will be adequate only if the current estimate of potential resources can be verified at a satisfactory rate. It is impossible to predict whether adequate supplies will be available, but clearly adequacy will not be achieved unless there is a substantial increase in industry exploration, begun immediately and sustained over a period at least ten years. The Federal Government should make a firm statement of policy, the Committee said, as to the desired role of uranium-generated power in the energy economy of the United States. If the policy calls for a significant role for nuclear energy, the Committee said, a firm commitment and supporting measures are needed to dispel uncertainty on the part of the mining industry and the public utilities as to the level of uranium supplies needed. Failure to make such a commitment will inevitably lead to a short-fall of uranium supply relative to the demands that currently are being forecast. The Committee pointed out that a long-term policy is made necessary by the 8–10 year lead time required for discovery and development of significant uranium reserves.

The search for additional uranium deposits is handicapped because the geologic processes and conditions controlling the formation of uranium deposits are inadequately understood, the Committee said. They recommended that the USGS expand its activities to include intensive studies of known uranium districts, including systematic geological mapping and investigation of the geochemistry of uranium deposition and migration, and that a broad spectrum of the scientific community be enlisted in these efforts. The Committee also recommended that the energy Research and Development Administration (ERDA) expand its own efforts—and support outside efforts—in research and development of new exploration techniques and the improvement of existing techniques, particularly those that might be applicable to non-sandstone deposits and to the deeper-seated sandstone deposits.

Serious competition for capital, shortages of trained scientific and engineering personnel, and shortages of materiel could become obstacles to an increased industry effort, the Committee warned, adding that the possibility of shortages of manpower and skills for uranium exploration should be studied by a panel consisting of representatives of ERDA, the uranium mining industry, and the universities.

The Committee further recommended: (1) That the Department of the Interior develop more expeditious procedures for issuing permits for exploration and acquisition of property in the public domain for mining; (2) that the uranium mining industry be encouraged to furnish to ERDA information obtained in the exploration of areas subsequently abandoned, including barren hole data; (3) that the USGS or ERDA, in cooperation with appropriate agencies, encourage radiometric logging of representative producing wells; (4) that ERDA support development of more accurate in situ assaying; (5) that USGS collect all available non-productive radiometric log information; (6) that ERDA institute a system of defining reserves and resources based on tonnages and grades of uranium deposits; (7) that continuing complete analyses be made by ERDA of uranium recoverable from current reserves and that the resulting figures be compared with updated figures for demand, the results to be published as soon as practicable.

GAS RESERVE ESTIMATION OF OFFSHORE PRODUCIBLE SHUT-IN LEASES IN THE GULF OF MEXICO

In an attempt to resolve the question of quantities of gas reserves available in the outer continental shelf shut-in leases, the Federal Power Commission (FPC) conducted a staff analysis of Louisiana and Texas outer continental shelf federal oil and gas leases that had been classified as producible shut-in by the U.S. Geological Survey (USGS). The FPC's two-part report considered 168 leases, and estimated a total of 7,992,904 cubic feet for proved and probable "reserves."

Serious questions were subsequently raised about the reliability of the FPC's gas reserve figures. It was suggested that the figures were too small and that substantial amounts of gas in these leases were being held off the market improperly. The Secretary of the Interior, therefore, directed the Geological Survey to ask the National Research Council to review the FPC gas estimates and the techniques and procedures used for estimating gas reserves of the offshore shut-in leases. In March 1975, the Panel on Gas Reserve Estimation was organized under the NRC Board on Mineral Resources in the Commission on Natural Resources.

The Panel selected a representative sample of 33 leases for detailed study and engaged two consulting firms with extensive experience in the offshore region to make independent "best," "high," and "low" estimates of physically recoverable gas based solely on the data that had been available to the FPC staff at the time of its analysis. The Panel then examined the estimates by the consultants, the FPC, and the USGS. Its report, *Gas Reserve Estimation of Offshore Producible Shut-in Leases in the Gulf of Mexico,* was published in March 1976.

The Panel found that for almost all individual leases, the total amounts of gas reported by the FPC were from two to three times higher than estimates by either of the consultants. The two consultants were, with only a few exceptions, in close agreement with each other. Exclusive of errors, the Panel said, the major differences in estimates of recoverable gas were due to interpretation of geological data in estimating reservoir volume and the fraction of gas that could be physically recovered from a reservoir.

Although, in the opinion of the Panel, the FPC had used standard engineering techniques in developing its estimates, the FPC redefinition and use of the term, "reserve," to represent gas that is physically recoverable, rather than the generally accepted sense of gas that is economically recoverable, gives misleading economic implications and "tends to confuse both professional and non-professional readers." The Panel pointed out that, according to usage of terms in the FPC report, a statement on gas "reserves" in "paying quantities" on "producible" shut-in leases refers to gas that is physically recoverable in theory, without regard for economic considerations, from wells that may or may not be possible to relocate or re-enter.

The Panel recommended that high and low estimates, as well as best estimates, should be reported in similar future investigations, and that the terms, reserve, paying quantities, and producible, should be used in their generally accepted sense and not be redefined for restricted purposes.

The Panel also concluded that the FPC practice of reporting a single figure for the estimate of physically recoverable gas—whether by reservoir or lease—tends to be misleading in that it fails to reflect the degree of uncertainty in the estimate.

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BIOLOGICAL OCEANOGRAPHY: SOME CRITICAL ISSUES, PROBLEMS, AND RECOMMENDATIONS

What organisms live in the sea? How are they distributed in time and space? What controls these distribution patterns? How do marine organisms survive? These questions are the core of biological oceanography, but as the report, *Biological Oceanography: Some Critical Issues, Problems, and Recommendations,* points out, "as we learn more about life in the sea, we also perceive more clearly the depth of our ignorance."

Biological oceanography draws heavily on the techniques and records of commercial fishermen. Like the fisherman, the biological oceanographer learns about the type and quantity of organisms beneath his ship by towing nets of different sizes. He must also contend with the remarkable range in individual size and distribution of marine populations. Bacteria are isolated by passing water through delicate membrane filters having a porosity of less than a thousandth of a millimeter, whereas large animals, such as whales, are estimated by sightings and by analysis of catch statistics. Although those sampling methods give some information about what species live in the oceans, they provide only a nebulous idea of temporal or spatial variations of these species. Improved biological oceanographic sampling techniques must be developed, the report says, if adequate quantitative data on the food potential, energetics, and pollution responses of the ocean are to be obtained.

A basic recommendation to improve sampling techniques calls for provision of funds to "use the best current technology on sampling problems; i.e., to charter a modern commercial pelagic trawler to allow biological oceanographers use of the large mid-water samples that can be collected from such vessels; and to equip research vessels with modern, narrow cone sonar equipment so that this potential biological remote sensing device can be investigated."

In addition to using more efficient sampling gear, biologists should also make greater use of less traditional techniques, the report suggests. Considerable acoustic technology exists, particularly within the military, that should also be applicable to biological studies. For example, studies using the Lowestoft sector scanning sonar have produced spectacular results. With this gear, marine biologists would have a much clearer perception of the spatial characteristics of animal distribution in the ocean. The report urges that "specific instrument design groups composed of cooperating engineers and biologists be established and funded to analyze and develop solutions for the problems that plague current approaches to sampling marine organisms."

Several lines of research are proposed in the report that will be necessary if we are to understand marine distribution patterns. For instance, the report cites two types of information that can contribute to the understanding of speciation in marine animals. The first is the extent of genetic variation and polymorphism within morphological species, and the second involves the concept of barriers to gene flow. These barriers may separate populations and permit them to diverge genetically, but the nature and operation of such barriers in the sea are poorly understood. An understanding of the evolutionary processes that control speciation in the sea will emerge only through detailed basic study, the report says. Basic systematics is a productive approach to these evolutionary questions, the report suggests, and collaboration between systematicists and paleo-oceanographers is essential.

Another research area is the highly variable recruitment among marine animals (i.e., a few adults may produce a large number of young one year, whereas a large number of adults may produce only a small number of young the next year). The reasons for the relative success or failure of different year classes are still largely unknown.

The three major factors controlling the survival of fish larvae are believed to be predation, the presence of the proper food in the correct density, and larval dispersal by water movements. In order to be able to predict larval survival and thus anticipate harvest during a particular year, the interplay of these factors must be understood in detail. It is equally important, the report points out, to understand the phenomena affecting recruitment of all organisms in the food web. The report suggests field studies in which natural fluctuations are followed with precision and where the physical circulation of the water is carefully studied, and laboratory studies that experimentally manipulate larval states.

According to the report, a major question in biological oceanography is whether biomes (communities of organisms that have evolved together in response to their environment and have positively influenced the environment in the direction of their needs) have evolved in the ocean. Because the marine environment is more continuous than terrestrial environments where discrete biomes can readily be identified, the identification of biomes in the sea poses a unique problem. It is clear, however, that oceanic regions differ in physical, chemical, and biological features. For example, three identifiable biomes are the blue water, low productivity (oligotrophic) regions resulting from weak physical circulation patterns, the coastal upwelling regions where strong circulation patterns predominate, and the deep sea, which is a dark and cold environment with little seasonal change of physicochemical conditions and characterized by high hydrostatic pressure. Little is known of the evolutionary adaptations of the species inhabiting these regions, and more information will be necessary to fully understand marine distribution patterns. Also important to our understanding of the ocean are studies of the biotic communities of sand and mud bottoms of the continental shelf to determine how many functionally different sand and mud communities can be distinguished.

The report points out that studies of shallow-water bottom communities, particularly those designed to assess the impact of a pollution incident or source, have failed to take proper account of the statistical requirements of such undertakings. Existing handbooks on benthic studies appear inadequate to correct this situation, and efforts should be made, the report says, to encourage the writing of a useful handbook on assessment of the concentration (abundance) of benthic animals for the purpose of comparing results obtained at different stations or at different times at one station.

Laboratory experimentation and field observations often lead to the conclusion that, on the average, there is not enough food in the sea to support the animals that live there. "We have known for some time," the report says, "that organisms are distributed in patches on a horizontal scale at the sea surface, but the spatial distributions of organisms below the surface is less well understood. The investigation of microlayers (less than 1 m thickness), the microdistribution of the food of planktonic animals (i.e., phytoplankton cells) within these layers, and knowledge of the persistence of these layers may lead to a new understanding of the food web and resolve the paradox of apparently insufficient food supplies."

The best hope for solving the important biological oceanographic problems lies in the individual insight and creativity to be found in small single investigator research projects, according to the report. Specifically, the report calls for increased support for systematic studies of marine organisms, particularly those that elucidate the genetic mechanisms through which oceanic species originated and evolved; behavioral studies of typical and foundation species in the marine environment; and studies of the role of microorganisms in energy flow and materials cycling in the sea.

Enhancement of the public's understanding of biological oceanography is essential to public support of biological oceanography research programs, and public funds must be administered as efficiently as possible. These goals might be achieved, the report says, if federal agency spokesmen make every effort to explain the scientific basis for their programs and to estimate their potential for public benefit, and if institutional policies encourage maximum use of publicly supported facilities, equipment, and laboratories.

The report, which was prepared by the Panel on Biological Oceanography of the Ocean Science Committee, Ocean Affairs Board, Commission on Natural Resources, resulted from a workshop held in November 1973. The Panel hopes that it will serve as a stimulus for a series of in-depth reviews of specific research topics.

SPACE APPLICATIONS

PRACTICAL APPLICATIONS OF SPACE SYSTEMS

Important advances in space systems have been made since the publication of the 1969 National Academy of Sciences report on space applications of earth-oriented satellites. Because of these advances, the National Aeronautics and Space Administration (NASA) asked the National Academy of Engineering to conduct a study of future applications of space systems, with particular emphasis on practical approaches, taking into consideration how these applications would influence or be influenced by the Space Shuttle system. The task was assigned to the Space Applications Board in the NRC Assembly of Engineering.

Under the Board's sponsorship, a representative group of users and potential users of satellite-generated information, drawn from commercial, industrial, and regional organizations and from state and local governments, was convened for a two-week study in July 1974 at Snowmass, Colorado. Scientists and engineers served as expert consultants during the meeting. At first, many of the participants had no conception of the relevance of space systems applications to their fields of interest. As the study progressed, however, the user panelists began to perceive useful services that could be applied to their respective activities. The users were then able to describe the types of information that would be useful to them and some of the potential benefits such information could offer. The Board's report, *Practical Applications of Space Systems,* is based upon the conclusions drawn during the study.

Weather and Climate

The First GARP (Global Atmospheric Research Program) Global Experiment, scheduled for 1978–79, will include intensive research on weather and climate—much of it recommended during NAS summer studies on space applications held in 1968 and 1969. Since then, however, uses other than those to be addressed by GARP have been recognized. For example, there is need for prediction of local weather for periods up to two hours to provide warnings of hazardous weather and for prediction of long-range weather and climatic conditions that could affect agricultural production. Much of the meteorological data provided by satellites could be used by groups other than weather forecasters, the Board pointed out, citing types of information that could be of use in agriculture and in hydrology.

Land-Use Planning

According to the Board, the sensors on LANDSAT–1 are adequate to provide data for preparing useful land-use maps on a national, regional, or state scale, and for determining where more detailed observations (from aircraft or the ground) are needed. Such maps would be helpful in determining whether land should be put to better use in farming or for some other purpose, whether sufficient and appropriate land is reserved for parks or other public uses, where to locate power plants, and the long-term effects of converting wetlands to human use. For urban land-use planning, sensors with a higher resolution (3 to 10 meters) than LANDSAT–1 now possesses are needed that can detect parking areas, observe traffic corridors, and recognize cultural features. The Board suggested that a single satellite, with appropriate sensors, could collect such information for all cities. It suggested, also, that the process of extracting information from earth observations should be automated and that simple, inexpensive equipment should be developed to permit rapid and economical processing of remotely sensed data.

Land planners at the meeting pointed out that more emphasis is needed in remote sensing research and development, including: (1) monitoring land-use patterns; (2) periodically surveying power plant sites, mining sites, coastal zones, wildlife habitats, geologic hazards, oil pipelines, and other areas at environmental risk; (3) determining the capability of the land to support proposed new uses without violating environmental, economic, or esthetic standards. The Board recommended that "any new federal land use legislation (and state legislation, if it is affected by federal standards) take into consideration the possibilities of acquiring data by the use of remote sensing from aircraft and space."

Agriculture, Forest, and Range

Analyses of LANDSAT-1 data have revealed some clearly successful experiments. These include: identification of crops and forest and rangeland vegetation; identification of soil and land-use patterns in agricultural areas; experimental detection, on a limited scale, of severe crop and forest damage due to insects, disease, drought, flood, or fire; estimation for small test plots of wheat acreage, yield, and production by use of satellite data in conjunction with a yield model incorporating meteorological data; identification of vegetative biomass in rangelands; monitoring of crop harvests in small trial areas; determination of irrigated acreages; and monitoring irrigation reservoirs and livestock water impoundments.

To be useful to agricultural management, some satellite-derived information must be furnished quickly. The Board, accordingly, recommended that the experimental off-line processing system at the Department of the Interior's Earth Resources Observation System Data Center and the procedures for transmitting information to users be modified so that information reaches users, in the format they need, within three to five days, and that this capability be developed in time to permit its use with LANDSAT-2 so that pre-operational experiments can be conducted.

Despite the value of satellite data in many applications, the Board found in discussions with various groups that federal, regional, and state agencies and private enterprises, having interests in land, food, and fiber resources, have been relucant to invest in serious experiments in the use of data from satellites because there has been no guarantee of continuity of data flow or of continuity in the format of data products. The Board, therefore, recommended that "to assure continuity of data and to assure progress toward an eventual operational system, LANDSAT-3 be developed and that plans proceed to launch it as a follow-on to LANDSAT-2.

Inland Water Resources

According to water-resource managers who took part in the study, satellites can help provide needed data through real-time sensing from space and by collecting data transmitted to the satellites from water- or land-based instruments and relaying the data to central collection points on the ground. Rapid assessment of danger and dissemination of warnings for floods and other storm hazards are needed. Real-time information on precipitation, snow cover and melt rates, and soil moisture and retention are essential to operate flood-control systems and to provide hazard warnings. Real-time information is also needed for water pollution monitoring and control.

In addition, it was pointed out that reservoir operators need forecasts of storm and seasonal runoff in order to control storage space for agricultural use, flood control, generation of hydroelectric power, and conservation of water supplies. For these needs, long-range (three months), intermediate-range (one week), and short-range (two days) forecasts of runoff would all contribute to better reservoir operation.

Extractable Resources

To date, about half of the sales of information (images and tapes) provided by LANDSAT–1 have been to the extractive industries. Improved weather information from the NOAA operational weather satellite system is of particular value to these industries because field camps, mines, and drill sites are often located in remote and primitive areas where local weather data are scant. The industry expects the importance of improved weather information to increase as off-shore mining and oil drilling move to deeper water.

Exploration crews working in remote and poorly mapped areas have been able to determine their positions within about one-quarter of a mile using a Navy navigational satellite, TRANSIT. According to exploratory geologists at the study, however, a position-determination capability of ±30 m (100 feet) is required. The Department of Defense is now taking the first steps to establish a global space-based position determination system, which, it appears, will have an accuracy even greater than ± 30 m. If this Global Positioning System—or NAVSTAR—is established and made available to the civil sector as well as the military, it will offer a great improvement in coverage and accuracy over existing systems. The Board pointed out, however, that if such a system were to meet both military and civil needs, new and sophisticated transmission equipment and computation techniques might have to be developed. Policy decisions will have to be made by the Executive Branch at an early date, the Board said, if the aerospace and electronics industries are to invest in the development and marketing of low-cost terminals for non-military use.

LANDSAT data have been helpful in locating new mineral deposits, even as an early experimental system. Improvements and advances in temporal and spectral coverage, such as the thermal infrared sensor under development for LANDSAT–3, would greatly enhance observations of the earth's surface features, particularly in areas with heavy cloud cover where there may be deposits of oil, gas, or minerals. The Board recommended that NASA continue its vigorous research and development program in new remote sensing techniques, that the thermal infrared sensor be added to the multispectral scanner on LANDSAT–3, and that emphasis be given to microwave scanners. It also recommended that NASA, in consultation with the extractive industries, pursue experimental use of LANDSAT to determine the effects of seasonal changes on images of the earth and to assess their usefulness for assisting in the discovery of minerals, oil, and gas.

To improve understanding of the process by which minerals are deposited near the earth's surface, the Board urged that "emphasis be placed on research and development programs related to earth physics, including the development of systems that can measure the relative displacement of tectonic plates to within ± 3 centimeters."

Environmental Quality

Recent federal and state laws call for a cleaner physical environment within ten years, and it has been estimated that more than $100 billion will be spent for pollution control during the next decade. The Environmental Protection Agency and NASA are already cooperating in programs to apply space technology to monitoring environmental quality. In this connection, the Board urged that "immediate steps be taken to make full use of currently available space techniques and systems in monitoring the environment, using both in situ and remote sensing instruments." It recommended further "that those elements of the space applications program which show promise of helping to fulfill regulatory requirements related to the environment be substantially accelerated."

Pointing out that most of the important processes affecting atmospheric pollution, as well as weather, occur in the troposphere, the Board recommended a vigorous program, "using sensors on the earth's surface, in aircraft, and in spacecraft, for monitoring the troposphere to assess on both regional and global scales the impact of air pollution and of air quality control." Specifically, it suggested the development of capabilities for all-weather, day and night measurements, and sensors to measure the vertical distribution of pollutants.

Plans should be made, the Board said, for monitoring the environmental quality of the stratosphere on a global level. Baseline measurements should be made of stratospheric gases and aerosols, with emphasis on the species involved in ozone chemistry; then, follow-up measurements should be directed at "determining the impact of man-made pollutants on significant stratospheric natural processes."

Marine and Maritime Uses

Possible applications of space systems to marine and maritime uses include better understanding, control, and use of the oceans' biological and physical processes, and technological aids that will enhance the safety and efficiency of maritime operations. Representatives of the maritime community who took part in the study identified three areas that should receive major attention: monitoring of the marine environment, communications, and position determination.

These three areas would encompass better forecasts of wind, waves, ice and storm hazards (both at sea and along coasts); improvement of fisheries through better monitoring of biological productivity and the physical variables upon which productivity depends; improved management of man's activities in the near-shore zone; enhanced power of maritime communication satellites; and lower-cost shipboard terminals that receive satellite data for position determination.

Experiments conducted since the study have demonstrated the feasibility of several techniques for position determination. The Board had concluded that the need now is to conduct systems demonstrations to permit users to gain more experience so that they may better specify their requirements.

Special Considerations—Satellite Communications

The recent past has seen an impressive series of accomplishments in global satellite communications, and it should be appreciated that appropriately designed and established domestic satellite communications circuits could widen the distribution and reduce the cost of reliable common-carrier voice, data, and television communication services throughout the country generally and improve service for those regions where there is relatively low population density, hostile terrain, or difficult climatic conditions.

Mobile services, which currently represent a multimillion dollar a year market in the United States, could also be improved. The effectiveness of air-sea rescue operations could be improved. Opportunities for using satellite communications circuits to speed and ease the delivery of mail, improve access for remote areas to cultural activities and certain education and health services, provide methods of warning of natural disaster, and distribute time and frequency signals to regions of the earth where conventional radio does not provide adequate service all appear to hold promise and should be explored further, the Board said.

Materials Processing in Space

The Board's report points out that some of the most effective processes for purifying biological materials and for manufacturing inorganic materials are inhibited to some degree by convective mixing that occurs in the presence of gravity when heat is introduced. The benefits could be large if certain high-cost and low-volume biologicals could be prepared in purer form than is now possible on earth. Representatives of the materials processing industry suggested that experiments in the processing of inorganic materials might advance knowledge about more perfect materials that could be derived in space and thereby lead to the improvement of processes on earth. Processing in space also holds the possibility of producing very small quantities of highly critical materials that cannot now be produced on earth.

Non-Technical Considerations

The report concludes with chapters that deal with institutional arrangements for taking advantage of the new capability, costs and benefits, and the common need for access to space by means of reusable space shuttles. The report cites the space transportation system being developed by NASA for use in the 1980's and the Spacelab being developed by the European Space Research Organization as systems whose planned performance will adequately accommodate spacecraft to meet foreseen user needs.

DISASTER STUDIES

LONG-TERM WORLDWIDE EFFECTS OF MULTIPLE NUCLEAR-WEAPONS DETONATIONS

This study was requested in April 1974 by Fred C. Iklé, Director of the U.S. Arms Control and Disarmament Agency, who asked the Academy to assess "likely consequences of nuclear weapons attacks," including "estimating the long-term worldwide effects that may propagate through the environment and ecological processes."

The study report, released in August 1975, was based on a five-day workshop attended by 56 scientists representing expertise in atmospheric physics, climatology, radiation ecology, agriculture, physical oceanography, and biology. Working groups, chaired by members of the Committee to Study the Long-Term Worldwide Effects of Multiple Nuclear-Weapons Detonations, were formed to consider six major subjects: atmospheric effects, natural terrestrial ecosystems, managed terrestrial ecosystems, aquatic environment, somatic effects on humans, and genetic effects on humans.

The study was based upon a scenario that postulated a massive exchange of nuclear weapons whose combined upper range of possible yield was of the order of 10,000 megatons (Mt) of TNT equivalent; the hypothetical exchange was between developed countries in the northern hemisphere. In its report, the Committee did not attempt to portray the utter horror that would befall the targeted areas and adjoining territories, nor the resultant mortality and property damage, but limited its study to phenomena occurring at continental distances from the detonations, the effects of which might be evident as long as 30 years after their occurrence. Primary consideration was given to physical and biological effects, although the Committee also recognized such indirect effects as loss of technological, agricultural, economic, and other capabilities and the impact of these losses on uninvolved countries even after a lapse of 30 years.

Although it was concluded that the human race would survive a major nuclear exchange in the northern hemisphere, the optimism of this conclusion was tempered by the projected miserable conditions of such survival and the destruction of world order and civilization that would probably follow.

As NAS President Handler pointed out in his letter of transmittal to Dr. Iklé, "The report notes the possibility that ionizing radiation might cause widespread damage to crops and domestic animals. However, perhaps surprisingly, outside the directly affected countries, the major predicted longer-term effects are thought to derive not from the dispersion of radionuclides but from an increase in the flux of ultraviolet radiation on the earth's surface due to reduction in the stratospheric concentration of ozone as the immediate chemical consequence of the injection into the stratosphere of a large pulse of oxides of nitrogen formed by the detonations. . . . Depending upon the actual magnitude of this effect, which is limited to the decade or two required for the ozone to be replaced by normal stratospheric photochemical processes, there will have occurred during this interim more or less severe, worldwide effects on climate, crop production, mutagenesis of pathogenic viruses and microorganisms, as well as a marked increase in the incidence of fatally intense sunburn, skin cancer, etc."

Among the Committee's observations and recommendations in the six major areas considered were the following:

Atmospheric Effects

An exchange of 10^4 Mt TNT equivalent yield would probably produce average fallout of strontium 90 of approximately 1 Ci/km^2 in the middle latitudes of the northern hemisphere. About two-thirds of this fallout would occur during the first year. The temperate latitudes of the southern hemisphere would receive about one-third as much total fallout. "Hot spots" of up to 30 times this amount could occur.

Dust and oxides of nitrogen injected into the stratospheric could lead to significant—possibly dramatic—climatological effects.

Preliminary results of a simplified model indicate that 30–70 percent reductions in the ozone column in the northern hemisphere and 20–40 percent reductions in the southern hemisphere, with a recovery time of two to four years, are possible. The Committee recommended that further consideration be given to modeling impulse loading of the stratosphere with nitrogen oxides.

Natural Terrestrial Ecosystems

Initial effects on natural terrestrial ecosystems in areas not involved in a nuclear exchange would be detectable and significant, but fairly complete recovery could be expected during the subsequent 25 years.

Of the several stresses associated with such an exchange, uv–B (ultraviolet radiation in the 280–320 nanometer range of wavelengths) has the greatest potential for producing effects on natural terrestrial ecosystems, and significant changes can be expected. Knowledge of the effects of uv–B on individual living organisms is meager, and the effects on entire ecosystems are unknown. The Committee recommended that greater effort be devoted to the planning and carrying out of studies of the effects of uv–B on entire terrestrial ecosystems.

Managed Terrestrial Ecosystems

After nuclear detonations of total yield of 10^4 Mt, some foods would be contaminated by radionuclides to levels approaching the upper limits of present standards. It is possible that ionizing radiation could cause disease epidemics in crops and domesticated animals on a global scale. The Committee recommended further study of mutation and virulence of pathogens in the presence of ionizing radiation.

A tenfold increase in uv–B would injure several crops, such as peas and onions, and certain animals. The Committee recommended that further research be undertaken on the effects of exposure to uv–B on crops and domestic animals.

Climatic change would shorten growing seasons in marginal areas. The C[illegible]mittee recommended that models of yield as a function of climatic con[illegible] refined.

Aquati[illegible]nvironment

Concentrations of radionuclides in seawater 20 years after injection would lead to a dose to man less than 2 percent of that due to natural background radiation and a dose to aquatic organisms no greater than the natural background radiation. Effects on man from consumption of radionuclide-contaminated seafood or on aquatic organisms from ionizing radiation would not be significant.

If the upper limits of ozone depletion should be realized, irreversible injury to sensitive aquatic species might occur during the years of increase in uv–B following the detonations. The Committee recommended further studies of the effects of uv–B in the aquatic environment, including studies of the penetration of uv–B in water and the avoidance reactions of organisms sensitive to uv–B.

A 1° change in average temperature of the aquatic environment associated with climatic change could reduce the range of geographic distribution of sensitive populations of aquatic organisms, but most would not be significantly affected.

Somatic Effects on Humans

In the first generation, an increase above the spontaneous cancer death rate due to exposure of low levels of ionizing radiation would be about 2 percent for a 10,000 Mt total detonation yield.

A 50 percent ozone column reduction lasting about three years would lead to an increase in the incidence of skin carcinoma and melanoma of 3 to 30 percent, with a geometric mean of about 10 percent for about 40 years, at midlatitudes.

Short-term effects of uv–B increase would be severe sunburn in temperate zones and snow blindness in northern regions. For a 70 percent decrease in ozone (the upper range of what might be expected), a severe sunburn involving blistering of the skin could occur in 10 minutes. Toxic effects due to an increased rate of vitamin D synthesis might occur.

Genetic Effects on Humans

If an ionizing radiation dose of 5 rem to the first generation is assumed, there would be in that generation an increase of 0.2 to 2 percent in the incidence of significant genetic diseases. About four-fifths of the effects of the genetic damage would be experienced by succeeding generations, with a half-time of approximately four generations.

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As Dr. Handler pointed out to Dr. Iklé, "There is reason to believe that the dependence of other nations on grain grown in North America to feed their growing populations will become increasingly severe for many decades. Patently, were the United States and Canada involved, these crops would be unavailable for an indefinite period after a nuclear exchange of the magnitude contemplated by this report—and the death toll due to starvation in the dependent regions must then rise accordingly."

Finally, he said, ". . . let no reader conclude from this report that distant other nations would survive a major nuclear exchange unscathed and, thereby, inherit the earth. The immediate physical and biological consequences of a major nuclear exchange to non-participating nations would, according to this report, be less prolonged and less severe than many had feared. But only on a relative scale. The economic, social and political consequences of the resultant worldwide terror are entirely unpredictable."

EARTHQUAKE PREDICTION AND PUBLIC POLICY

Seventy million people throughout the United States live with a significant risk to their lives and property from earthquakes. Another 115 million are exposed to a less significant, but still appreciable, risk. Although most of the earthquakes in the United States occur in the western states, Alaska, and Hawaii, parts of the eastern seaboard and the Mississippi Valley have suffered severe earthquakes within the recorded history of the United States and may be expected to again.

The report, *Earthquake Prediction and Public Policy,* prepared by the Panel on Public Policy Implications of Earthquake Prediction of the Committee on Emergency Preparedness, points out that, within the past five years, many seismologists have become convinced that the capability of predicting earthquakes is imminent and that it will soon be possible to specify, within fairly close limits, the time, place, and magnitude of an earthquake. Established methods for identifying high-risk areas depend largely on the past incidence of quakes and the mapping of fault structures. The new methods rely primarily on premonitory signs, such as changing physical properties of rocks under stress and surface tilting, that occur before an earthquake and that may predict an earthquake within a timeframe of days, weeks, or years. Predictability of earthquakes is still in the research stage, however, and will require networks of instrumentation, as well as predictive experience, to perfect theory and technique. The potential for saving lives and property merits intensive research effort and government support, the Panel said.

The Panel pointed out that once the public knows of the ability to predict earthquakes, the demand for prediction will be insistent. To avoid withholding information that might save lives, some predictions will inevitably be made on the basis of unreliable evidence.

The most prominent characteristic of strong earthquakes is violent shaking, which results in vibrations, avalanches, soil liquefaction, lurching, seiches, regional uplift and subsidence, fault breaking reaching the earth's surface, and tsunamis. The primary effects are death, injury, damage to systems and structures, and disruption of normal activities. Predictions of such earthquakes, followed by concerted protective measures, would save many lives and lessen property losses. Difficult to assess, however, are the less tangible effects of long- to intermediate-term predictions on the attitudes and behavior of the affected population.

Judging by evidence from other threatening situations, the Panel said, most inhabitants of an area will probably attempt to continue life as usual. The foundation of the regional or local economy may be significantly influenced, however. According to the Panel, "Regional and national business and financial associations may decide to limit mortgages, insurance, and investment in the threatened area. There may be outmigration of sizable numbers of people, and the tourist trade may be adversely affected. If some or all of these conditions continue throughout a long pre-earthquake period, secondary effects such as rising unemployment, falling property values, and reduced community tax revenue will ensue. The latter development would quickly become the focus of political concern and recrimination." The Panel recommended that, upon issuing an earthquake warning, a joint governmental and private-sector commission be established to monitor the economy in the threatened area to ensure early detection of changes and to make recommendations to the government, business, and labor organizations as needed. Representatives of insurance and investment organizations should play an integral role in the work of the commission, the Panel said.

Depending upon the time available, a number of steps are listed in the report that can reduce earthquake hazards. For example, with long periods of advance warning, land-use management can be a potent tool for reducing death and injury, property loss, and community disruption when a serious earthquake does occur. Strict codes can be enforced to ensure that new construction is earthquake-resistant; new construction can be halted or timed to avoid the danger of collapsing unfinished buildings; older structures can be identified and either demolished or reinforced; populations at exceptional risk, such as those living in substandard housing, can be relocated or plans made for their evacuation prior to an earthquake; and all areas of emergency planning can be expanded and refined. At the time of the prediction, the affected community will also need to develop plans for reducing potential special risks. Such steps as lowering the water level behind dams; reassessing the safety features in facilities for the manufacture, transportation, and storage of toxic, chemically reactive, and radioactive materials; and dealing with local fire hazards may be considered.

Any hazard-reduction program will be expensive, the Panel said, though with effective planning the costs should be offset by reduced property loss and economic disruption from the actual quake. The longer the period of advance warning, the greater the possibilities for absorbing much of the cost regionally. It is accepted policy for federal and state governments and private agencies to provide massive financial and other assistance after disaster has struck. A crucial step toward effective hazard reduction is recognition that much of this assistance should be available to a community before the disaster strikes, when there is a well-authenticated prediction. The Panel suggested that new legislation should be enacted as required to achieve this end. Also suggested was a thorough study of the potential role of insurance as an approach to the problem of hazard reduction and of the potential and economic implications of alternatives to the current system of voluntary earthquake insurance.

"The effectiveness of programs to reduce exposure to natural hazards and lessen their impact depends largely on the initiative and intelligent involvement of government at the state and local levels . . . However, there is again an important role for the federal government to play. The federal government is in a more favorable position than state or local governments to provide technical advisory services in the face of local and regional political crosscurrents," according to the Panel. Also, "the federal government must serve as the focal point for formulating standards and guidelines for earthquake preparatory measures, for developing seismological systems needed for achieving predictions, and for funding and stimulating earthquake-prediction research."

The Panel concluded that "Whether or not present skills in earthquake prediction can be molded into a program acceptable to the public and useful in reducing loss of life and property will depend in part on (a) the development of an effective means of authenticating earthquake predictions and of defining and communicating the urgency of initiating preparedness measures to planning officials who must implement these measures, and (b) the development of effective procedures and terminologies for communicating information to the public. If a national program to serve this purpose is to be developed and is to grow with future advances in earthquake-prediction skills, there must be a carefully orchestrated effort by both federal and state governments that makes effective use of the unique resources and competencies inherent at the federal, state, and local levels of government."

PART II: INTERNATIONAL ACTIVITIES

INTERNATIONAL ORGANIZATIONS AND PROGRAMS

The international activities of the National Academy of Sciences are the responsibility of the Academy's Foreign Secretary, George S. Hammond, assisted by his staff in the Commission on International Relations. The Commission manages scientific exchange programs between the United States and communist countries, effects U.S. participation in international nongovernmental scientific organizations and programs, and promotes international development through science and technology.

The Academy's principal vehicle for communication with the scientific communities of other countries is the International Council of Scientific Unions (ICSU). In October 1976—the U.S. Bicentennial Year—the Academy will host the ICSU General Assembly in Washington, D.C. Professor Harrison Brown, previously Foreign Secretary of the Academy, is the current President of the ICSU. In conjunction with the Assembly, the Academy will present a symposium on the past, present, and future of the interaction of science and technology with the social matrix that both confines and enhances the human enterprise in the world.

Through U.S. national committees established in appropriate Assemblies and Commissions of the National Research Council, the Academy adheres to 16 of the 17 ICSU Scientific Unions, 11 ICSU Committees and Scientific Associates, and 11 international scientific organizations that are not members of ICSU. These U.S. committees arrange for U.S. participation in international congresses and programs, administer travel grant programs, plan symposia and conferences, and otherwise serve the U.S. scientific community in international activities.

Several international studies and programs (e.g., the Global Atmospheric Research Program (page 112), the International Environmental Programs Committee (page 129), the Geophysics Research Board (page 107), and the Polar Research Board (page 110), are administered by Assemblies and other Commissions of the National Research Council. The Foreign Secretary is, *ex officio*, a member of each group.

HUMAN RIGHTS

The Academy has been subjected to criticism by fellow scientists, including some of its members, who feel that the Academy should play a more visible role in protesting unreasonable repression in other countries of personal freedom and the freedom of scientists to work. At its annual meeting in April 1976, the Academy adopted guidelines on human rights, drafted by the Foreign Secretary, and an "affirmation of freedom of inquiry and expression," the text of which follows:

> I hereby affirm my dedication to the following principles:
>
> That the search for knowledge and understanding of the physical universe and of the living things that inhabit it should be conducted under conditions of intellectual freedom, without religious, political or ideological restriction.
>
> That all discoveries and ideas should be disseminated and may be challenged without such restriction.
>
> That freedom of inquiry and dissemination of ideas require that those so engaged be free to search where their inquiry leads, free to travel and free to publish their findings without political censorship and without fear of retribution in consequence of unpopularity of their conclusions. Those who challenge existing theory must be protected from retaliatory reactions.
>
> That freedom of inquiry and expression is fostered by personal freedom of those who inquire and challenge, seek and discover.
>
> That the preservation and extension of personal freedom are dependent on all of us, individually and collectively, supporting and working for application of the principles enunciated in the United Nations Universal Declaration of Human Rights and upholding a universal belief in the worth and dignity of each human being.

INTERNATIONAL EXCHANGE PROGRAMS

BOARD ON INTERNATIONAL SCIENTIFIC EXCHANGE

This Board, established two years ago by the Commission, is undertaking a review of the Academy's 18-year old exchange program with the Soviet Union. The Board also desires to study the patterns of interaction that have developed during the past two decades between scientists in the United States and in such nations as Japan and Great Britain. This work reflects the apprehension that there may be considerable deterioration in the quality of these interactions, as evidenced by the decline in attendance at most international meetings.

THE COMMITTEE ON SCHOLARLY COMMUNICATION WITH THE PEOPLE'S REPUBLIC OF CHINA

The exchange program with the Scientific and Technical Workers' Association of the People's Republic of China (PRC) has progressed according to an originally established pattern of short survey visits by small groups of scholars in specific fields. During the past 12 months, the Academy has sent 5 delegations to China and has received 6 Chinese delegations; the Committee was also host to a high-level delegation from Peking. Several reports by U.S. delegations have been published, including: *Childhood in China*, *Earthquake Research in China*, *Herbal Pharmacology in the People's Republic of China* (see page 54), and *Language and Linguistics in the People's Republic of China* (see page 57).

The Committee, representing three principal scholarly organizations—the National Academy of Sciences, the Social Science Research Council, and the American Council of Learned Societies—continues to urge more interaction with the Chinese, and although the Chinese have been reluctant to move beyond short tours, they recently have agreed to include research seminars as part of the programs for exchange delegations. The Committee also has taken a strong stand in asking for numerical equivalence between the numbers of delegations sent and received.

ADVISORY COMMITTEE ON THE USSR AND EASTERN EUROPE

Exchange activities between the National Academy of Sciences and the academies of the USSR, Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia continued during this period, with the financial support of the National Science Foundation and the approval of the Department of State. These programs enabled American scientists to visit and conduct research in institutes of the academies and other research facilities in those countries, and provided foreign scientists with the means to undertake similar activities in the U.S. However, because of reduced funding, the Academy has had to cut back the total level of exchange activity during the period and, because of other constraints, new initiatives in the area of scientific exchange, particularly with Bulgaria and Yugoslavia, have had to be postponed.

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS

The International Institute for Applied Systems Analysis (IIASA), which was chartered a little more than three years ago by the Academy and the scientific institutions of 11 other countries as the first multilateral, nongovernmental, scientific institution for the study of problems common to industrialized nations, appears to be gaining the confidence of a broad segment of the scientific community. The Institute, located in Austria, is beset by grim financial problems arising from the worldwide inflation and the relative decline of the dollar—the currency in which participation fees are assessed—in comparison with the Austrian schilling.

WORLD FOOD AND NUTRITION STUDY

This study was undertaken at the request of President Ford, who cited the responsibility of advanced nations to work toward a worldwide increase in the production of food. The Steering Committee for the study is administered by the Commission on International Relations. The Committee's report, *World Food and Nutrition Study: Interim Report,* the report of the Board on Agriculture and Renewable Resources, *Enhancement of Food Production for the United States,* and *Recommended Actions on Nutrition Research* *and Development* by the Food and Nutrition Board were published during the year (see page 15). The final report of the Steering Committee will be published and sent to the President in June 1977.

OCEAN POLICY COMMITTEE

During the year, the Ocean Policy Committee was transferred to the Commission on International Relations from the Commission on Natural Resources. The Committee is concerned with the importance of current negotiations concerning the law of the sea and their possible impact on marine research in coastal waters throughout the world. In a recent report, *Marine Scientific Research and the Third Law of the Sea Conference, 2nd Substantive Session,* the Committee concluded:

> Although it is possible that a Law of the Sea treaty might be worse for science than no treaty at all . . . a treaty can offer a brighter future for science. There is likely to be less dissatisfaction with a treaty and with negotiated agreements pursuant to it than there would be if boundaries, rules, and resources were in a constant flux and were therefore a matter of dispute. . . .
>
> We believe it is shortsighted to adopt an international treaty on the law of the sea that severely restricts the opportunities of scientists around the world to contribute to the solution of these [problems of worldwide pollution, food production, and long-range weather prediction] and other problems. We further believe it imprudent to adopt a treaty that fails to recognize the need to expand man's knowledge of the sea and that restricts the pursuit of such knowledge.

BOARD ON SCIENCE AND TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT

Over the past 11 years, this Board has engaged in a program of workshops, studies, and advisory activities aimed at focusing U.S. scientific and technical resources on the process of social and economic development in the less developed countries. These activities, performed in cooperation with counterparts in the host countries, have provided a unique mechanism for gaining valuable insights, stimulating recognition of the importance of science and technology in development, and catalyzing the formation of policies and programs. More than 1,200 persons from U.S. universities, research institutes, government agencies, and private industry have contributed their time to BOSTID workshops and studies.

During this period, the Board cooperated with the National Science Foundation in holding the first scientific activity of the Working Group on Technology, Research, and Development under the U.S.-Egypt Joint Cooperation Commission. In May 1975, a Symposium on Science Policy Planning was held, followed by a Workshop on Science and Technology Policy, Planning, and Management. Both of these activities were organized jointly with the Egyptian Academy of Scientific Research and Technology and the University of Cairo.

Following a study by BOSTID's Advisory Committee on Technology Innovation on the Utilization of Aquatic Weeds, the report of which will be published shortly, a regional workshop on Aquatic Weed Management and Utilization in the Nile Basin was held in Khartoum in November 1975 in cooperation with the Sudanese National Council for Research and with Egyptian, Ethiopian, German, Indonesian, and Mozambiaquan participation. As a result of the workshop, steps have been taken to introduce, under controlled conditions, water hyacinth weevils as a biological control mechanism to complement chemical control measures. Experimentation is being carried out to utilize the water hyacinth for animal feeding, compost, and methane generation.

The exploitation of useful plants was the topic of a workshop on Natural Products for Sri Lanka's Future, jointly organized with the National Science Council of Sri Lanka in the summer of 1975. Recommendations called for a revival of intercropping of pastures and other crops with coconuts; increased production of passion fruit, kenaf, citronella, citralvetiver, and patchouli oil; and for consideration of exotic floriculture for export. Increased support for basic and applied research is seen as critical, as is improvement in library and instrumentation facilities. Proposals were made for an international chemistry program to support chemistry research in Sri Lanka, and for the preservation of endangered plant species.

In focusing on specific problem areas, BOSTID published two reports that have gained international attention and recommended research is already under way in several parts of the world. These are: *The Winged Bean: A High-Protein Crop for the Tropics* (see page 52) and *Underexploited Tropical Plants with Promising Economic Value* (see page 53).

Another published report which has received as much attention in the developed world as in the developing countries is *Systems Analysis and Operations Research: A Tool for Policy and Program Planning* (see page 60).

BOSTID's program with AID graduate or near-graduate countries continues. A workshop on Industrial Innovation and Product Development was held in Taiwan in August and a joint panel on the establishment of a Korea Science and Engineering Foundation met in Seoul in May. BOSTID is cooperating with the Brazilian National Research Council in a program to strengthen research on biological nitrogen fixation, and is considering collaboration in a floral inventory of the Amazon region—a program of intense interest to botanists in Brazil, the U.S., and other countries. The latter project is particularly urgent as the area under consideration is already undergoing development and there is a high probability that the consequent ecological disturbance will seriously affect the unique plant species existing there.

PUBLISHED INTERNATIONAL STUDIES

THE WINGED BEAN: A HIGH-PROTEIN CROP FOR THE TROPICS

In 1974, an Academy panel conducted a survey of 36 species of underexploited tropical plants that are potentially promising as future food crops (see page 53). Among the most promising was the winged bean, *Psophocarpus tetragonolobus,* a little-known tropical legume that is grown almost exclusively in Papua New Guinea and Southeast Asia as a backyard crop. This plant showed such exceptional properties that an international panel was convened by the Academy in October 1974 to evaluate available information; assess the potential of the winged bean as a crop plant; identify data gaps and research needs; and outline a strategy for international research and testing to assess the crop's future. The panel's report, *The Winged Bean: A High-Protein Crop for the Tropics,* was released early in fiscal year 1976.

Because edible legumes are excellent sources of protein and oils, many nutritionists expect them to play a significant role in alleviating hunger and malnutrition, especially in developing countries where there are serious problems of protein deficiency. The winged bean equals or surpasses the soybean in protein content and, in contrast to other high-protein legumes, grows vigorously in humid tropical regions or, if irrigated, in more arid tropical soils. The winged bean plant has an extensive root system, with more and larger nodules than are found on the roots of other edible legumes. Tropical soils are often poor in nitrogen, but the winged bean can grow in poor soil as a result of its ability to fix nitrogen from the air.

Practically all parts of the winged bean plant are edible and palatable, as well as rich in vitamins and protein. The young pods, leaves, and flowers may be eaten raw or cooked as vegetables. The tuberous roots are rich in protein (12–15 percent wet weight, more than 20 percent dry weight), and are eaten like potatoes. Mature seeds can also be eaten, but must be cooked for two or three hours. Flour made from winged bean seeds has been found suitable as a milk substitute in the treatment of children suffering from kwashiorkor.

Like soybeans, winged bean seeds are rich in oil. Of the fatty acids in the oil, 71 percent are unsaturated. If extracting the oil becomes commercially feasible, the panel said, the residual meal should be an excellent protein source analogous to soybean meal.

The panel pointed out that what is known today about the winged bean is "roughly tantamount to what was known about the soybean 60 years ago, shortly after its commercial introduction into the United States. Many advances in the genetic improvement of the soybean could be applied to the winged bean. It is possible that the winged bean may be as significant for world agriculture in the future."

A germ plasm collection is the first and most crucial need for rational and efficient agronomic development of the winged bean, the panel said. The institution maintaining the seed bank should be prepared to grow promising varieties and to distribute seed to agronomists. In addition, the panel recommended that research institutions in four or five tropical locations maintain living collections and begin small-plot trials and plant-improvement programs, focusing on increasing the yield of various parts of the plant, including pods, seeds, and tubers; increasing the combined yield of both tubers and pods on the same plant; increasing possibilities for large-scale commercial cultivation of dwarf and erect plants; and increasing the resistance to disease and pests. The panel pointed out that disease could become a problem with the introduction of monoculture.

The panel recommended that research be undertaken on the nutritional aspects of the winged bean, including work on the nutritive effectiveness of the protein (its efficiency ratio and net utilization); research to determine levels of trypsin inhibitors and hemegglutinins and methods to detoxify them; identification of the amino acid composition of leaves, pods, and tubers and determination of amino acid composition differences between winged bean varieties for each portion of the plant.

Research is particularly needed, the panel said, on the extraction of oil and the use of the residual protein-rich seed meal in food. The preparation of a winged bean milk, curd, or gruel (particularly for the feeding of infants) should be examined also, as well as the possibility of fermenting winged bean seeds to products equivalent to the soybean-derived miso and tempeh.

Pointing out that social mores—particularly important in the feeding of weanling children—are as important as the availability of suitable products in determining dietary practices, the panel called for sociological studies in those areas where winged beans are to be introduced. Cooking methods and the home economics of the winged bean, especially at the village level, should also be investigated, the panel said.

UNDEREXPLOITED TROPICAL PLANTS WITH PROMISING ECONOMIC VALUE

Throughout history, man has used some 3,000 plant species for food; at one time or another about 150 of these species have been cultivated. Today, however, there is worldwide dependence for food on about 20 crops—cereals (wheat, rice, maize, millet, and sorghum), root crops (potatoes, sweet potato, cassava), legumes (peas, beans, peanuts, soybeans), and sugar cane, sugar beet, coconuts, and bananas—which stand between man and starvation. Research is urgently needed, not only to increase the yields of these crops, but to develop other promising underexploited sources of food, feed, and raw materials to replace or supplement dwindling supplies of nonrenewable resources.

The report, *Underexploited Tropical Plants with Promising Economic Value,* describes 36 tropical plants that have potential for development as economic crops in developing tropical countries. For each plant, the report details the potential value, the limitations, and the research needed if an economic crop is to be developed. The plants were selected from a list of 400 candidates nominated for investigation by plant scientists around the world. Selection was based on the following criteria: Can it be grown in the tropics? Does it have significant potential as a source of food, forage, or industrial raw material? Can it help make developing countries (or areas within them) more productive? To keep the study a manageable size, medicinal plants and timber species were excluded. The report points out that many of the plants that were recommended but not selected may well have potential for similar exploitation.

Only through careful preservation and thorough cataloguing will the genetic diversity and healthy stock needed for developing new food crops be assured, the report says. At present, one of every ten plant species is in imminent danger of extinction because of wanton destruction of vegetation and displacement by conventional agriculture. To save these endangered species, the number of botanic gardens, field stations, and unspoiled habitats, as well as personnel trained in tropical plant science, must be increased. Facilities for training and research in tropical botany should be established rapidly, the report advises, because the time left for the study of undisturbed tropical vegetation is growing short.

Noting that most of the tropical countries cannot afford to devote the time and money for investigating the lesser-known plants, the report suggests that development agencies and foundations consider sponsoring a system of horticultural facilities in tropical and subtropical developing countries to pursue agronomic research and extension on lesser-known indigenous and newly introduced species, possibly as extensions of the network of international agricultural research institutions already in existence.

According to the report, most agricultural scientists are unaware of the scope and potential offered by tropical botany, largely because the major centers of scientific research are located in temperate zones. In studying tropical economic botany, the report comments, it is not enough to consider solely traditional needs and markets. New raw materials also will be required in the future. Changing conditions are already creating demands for new products from previously underexploited plants; more will be needed as pressures increase for the exploitation of renewable resources.

HERBAL PHARMACOLOGY IN THE PEOPLE'S REPUBLIC OF CHINA

In June 1974, a delegation of twelve U.S. specialists in chemistry, medicine, pharmacology, pharmocognosy, pharmacy, and Chinese culture, sponsored by the National Research Council Committee on Scholarly Communication with the People's Republic of China (PRC), visited a series of major Chinese cities to assess the current status of herbal pharmacology. The delegation submitted its report to the Committee and it was published late in calendar year 1975.

The delegation found that politics permeate every activity in the PRC and science exists to serve the people. Self-reliance in all fields is an ultimate goal set forth by Mao tse-tung, and scientists are taught that they must combine what is useful from the West with native devices and discoveries in order to meet the needs of the nation. In pharmacological work, this effort is expressed in Mao tse-tung's formula calling for the union of Western and Chinese medicine.

According to the report, since 1949 the Chinese have supported traditional medicine because Chinese-style physicians were an important available resource and because the tradition itself stemmed from popular folk roots. Although their intent at first was to westernize traditional practitioners, in 1954 there was a dramatic shift in emphasis and the government founded research institutes to explore Chinese medicine and pharmacology, described by Mao as a "great treasure house" for the Chinese people. During the "Great Leap Forward" of 1958, programs were started to train Western-style doctors in Chinese medicine. Much of Chinese medicine is based on herbal remedies, many of which have been in use for centuries. The union of traditional and Western medicine has yet to prove its durability, however, and an empiric eclecticism now exists, rather than a full integration of the theory and practice of both systems. Despite political pressures, the delegates found that Western medicine still seems to be in the ascendancy.

The U.S. group was impressed with some of its observations of the clinical wedding of traditional and Western medicine. For example, the treatment of acute abdominal conditions by nonsurgical means included appendicitis, perforated ulcers, acute peritonitis, and common duct stones. All of these conditions are treated with one or more of the following: acupuncture, Chinese herbs, and Western-style medical care. For simple acute appendicitis, the treatment is a combination of certain herbal medicines to promote blood circulation and, occasionally, aspiration of the abcess. Of 995 cases reported to the U.S. delegation, 93.6 percent made an uneventful recovery. If there was suppuration, the success rate dropped to 76 percent; when there was peritonitis, the rate was 50 percent.

Although herbal pharmacology is seldom involved in orthopedic problems, the delegation spent two days in orthopedic hospitals reviewing the nonsurgical reduction of broken bones. Using acupuncture as the only anesthesia, a patient's broken forearm was stretched apart at the fracture site by two doctors, while a third doctor molded the bones in place. Short splints were applied immediately and tied with bandages, after which the patient was asked to start exercising her hand. In another case, the delegation saw two women with compression fractures of the lower spine. Rather than placing them in body casts, the women were taught how to do "bridging" exercises in their beds. By their own efforts and will, they were effecting their own cures. "Orthopedics in China thus shows the vitality of clinical medicine there along practical lines, eliminating what may be unnecessary operative interference and making the treatment of disease simple. . ." the delegates said, adding that "All this is done without any obvious sacrifice of good medical treatment or postoperative care."

In the case of cancer and other serious diseases, when there are existing efficacious Western drugs, herbal remedies are often not used or are only added to existing regimens in a "supportive" way.

The delegates reviewed herbal treatments for infectious diseases, noting that except for narcotics and penicillin, virtually all Western and Chinese drugs are freely available without a prescription. They were unable to assess any harm caused by the availability of drugs "across the counter." Also reviewed were treatments for cardiovascular diseases, neurological diseases, burn units, and eye diseases. A large number of traditional herbal preparations were observed in use in hospitals throughout the PRC. An appendix to the delegation's report contains a detailed analysis of those prescriptions. In many cases, it was found that the prescriptions could, indeed, be effective for the conditions indicated. The group suggested that, since the active principles of these plants have, in general, not been isolated and identified, there is fertile ground for further investigation by natural-product chemists, pharmacognosists, and pharmacologists desirous of finding new, biologically active compounds from plants.

Although biochemotaxonomic analysis supports therapeutic claims for many herbal medicines, the delegates were unable, on the basis of clinical evidence alone, to come to firm conclusions about any specific traditional drug. They pointed out that the courses of most symptoms or diseases are unpredictable, there is almost total absence of controlled trials, there is cultural objection to the use of placebo controls, and multiple forms of drugs, including Western drugs, are administered simultaneously.

There is no organization in China analogous to the U.S. Food and Drug Administration, nor did the delegation find that the lack of such an agency has hampered China in any significant way. The present policy is to pursue animal studies after clinical utility has been established for traditional medicines—a policy that the delegates considered eminently defensible for drugs that have been in use for many years with apparent safety.

While, in themselves, the politicization of student selection and curriculum reform do not necessarily have an adverse effect on China's science, in the view of the delegates, the de-emphasis on pure research, the emphasis on developmental research, and the pejorative attitude toward scientific credentials will have an adverse effect on scientific advancement in China and on the development of competent staff for China's research institutes in the future. The group felt that it is essential for the future of science in China that younger staff members be kept in touch with worldwide scientific development in anticipation of the day when the present Western-trained scientists have retired or died.

According to the delegation, national priorities concerning disease states are quite similar in China and the United States. Both countries have more or less disposed of some major infectious disease problems and are concentrating on specific diseases, such as cancer, heart disease, stroke, and pulmonary disease in the United States, and bronchitis, hypertension, and cancer in the People's Republic.

The delegation concluded its report with the following statements:

> Perhaps the most significant impact felt by the scientific members of the delegation came from the challenge to basic assumptions long held by our own society. What we saw of acupuncture analgesia; Chinese orthopedic practices; their nonoperative approach to kidney stones, appendicitis, and perforated peptic ulcer; the geographical incidence of certain cancers; cataract surgery; burn treatment; their methods of dispensing drugs; and the respect for the opinions and experience of both patients and physicians was extremely provocative and suggested a need for Western scientists to re-examine some of their favorite dogmas.
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> For the future, we believe that great benefit would accrue to both China and the United States if exchanges of scientists, for prolonged periods, with opportunity for close interaction, could be arranged. In addition, we believe that Chinese pharmacologists visiting this country would profit from visits to our drug industry, the FDA, and schools of medicine. . . .

LANGUAGE AND LINGUISTICS IN THE PEOPLE'S REPUBLIC OF CHINA

The eight-member American Linguistics Delegation, which visited the People's Republic of China (PRC) from October 16 to November 13, 1974, was the seventh of nine delegations to visit China under the auspices of the National Research Council Committee on Scholarly Communication with the People's Republic of China and the National Scientific and Technical Association of the PRC. Some of the Delegation's findings and observations follow:

As in many other countries, the People's Republic of China has many local dialects, regional standards at several levels, and a common national language standard—Putonghua—which is based on the pronunciation of the general Peking district in northern China, and was adopted as the common tongue by the State Council in 1956. At the same time, the State Council adopted a plan for written character simplification and a Latin alphabet orthography, pinyin, that was disseminated to local authorities throughout the country.

Although Putonghua and the eight major dialects spoken in China share the same ideographic script, the spoken language from one region to another is unintelligible to speakers of other dialects. For example, the county of Datian in Fujian province has three major and more than ten minor dialects. A cadre from the North needed three to seven interpreters to make a speech. Obviously, the national development of China requires a rationalization of the language. While a romanized alphabet would solve the technical and educational drawbacks inherent in the character system of Chinese script, such a phonetic alphabet will only be practical when all Chinese speak the same language.

The language reform movement in China is without parallel in the magnitude of the problem and the number of people affected. The State Council asked all the schools of the nation to use Putonghua as the medium of instruction beginning in the autumn of 1956, thus changing the dominant pattern of using the local dialect in teaching. In 1958, Premier Chou En-lai announced that the popularization of Putonghua was an important political task, the People's Congress approved the use of pinyin as a tool for the spread of Putonghua, and Chairman Mao declared that all cadres (party and administrative workers) must learn to speak Putonghua. The basic policy for spreading Putonghua consists of three principles: (1) To encourage people to speak Putonghua on more occasions, (2) to select particular places and social groups for promotion, and (3) to go gradually, "step-by-step." As with the use of Putonghua in speech, the ultimate goal in writing appears to be a full shift to alphabetization, though the policy is one of extreme gradualness.

Children are introduced to the written language of Putonghua when they enter primary school; in most cases they have learned to speak Putonghua in nursery school and kindergarten. Pinyin is the first written system studied. By the time children enter middle school, it is assumed that they have mastered pinyin; it is no longer taught, but is generally used. At all course levels in primary and middle schools, the major aim of Chinese language instruction is to change the ideology of the students and raise their socialist consciousness. For example, the classics are studied as part of the movement to criticize what are considered the reactionary teachings of Lin Piao and Confucius. Poetry and other literature are also interpreted from an ideological point of view. Many changes in teaching techniques, classroom procedures, and attitudes toward teachers as authoritarian figures have taken place since the Cultural Revolution and during the on-going Educational Revolution. From primary school on, students combine socially productive work in field or factory with schoolroom activities in an effort to combine theory and practice. In effect, the schools are open systems, so much so that it is difficult to know where the systems end and the environments begin.

College-level teaching of the Chinese language has similar aims. Here, too, the study of classical and modern Chinese is intimately involved in the Chinese educational policy of serving proletarian politics. As in the primary and middle schools, Chinese instruction in the universities is conducted by the Open Door method. Both faculty and students spend at least one month of the year doing physical labor and "learning from the workers and the peasants."

Chinese is taught to foreigners at the Peking Language Institute or other language institutes by teachers who have some competence in the native language of the student. A basic set of materials is used for all languages, with appropriate glosses in the student's native language. At the time of the Delegation's visit, there were 340 students in residence from 40 foreign countries. Course contents are varied according to the needs of the students, beginning with words and phrases used in daily conversation. The topics spoken of in everyday life in China, such as politics, social activities, health, and production, make up the main course content. Students of science, technology, and agriculture are taught the technical vocabulary of their specialty. In order to learn Chinese, the students must know China, its communes, factories, and May 7th Cadre Schools. Courses are arranged, therefore, in the Open Door Way, whereby students go out and talk with workers, peasants, and members of the People's Liberation Army.

Foreign languages are taught in urban Chinese primary schools, starting with the third or fourth grades, and are offered in every middle school for the full five-year and senior years as part of the standard curriculum. All normal and general universities have foreign language departments, but not all students are required to study a foreign language. English is by far the most widely taught foreign language in the People's Republic. Apparently, however, little if any attention is given to learning a foreign language in relation to the economic, social, political, and cultural milieu of native speakers of those languages.

Few monolingual or bilingual dictionaries are now available in the open market in China. The importance of lexicography and the inadequacy of existing dictionaries is recognized, however, and work is going on in many places to meet immediate needs for both monolingual and bilingual dictionaries. There was no evidence of national coordination of this work. Political correctness of content is apparently the most difficult problem facing general lexicographical work.

The emphasis in Chinese schools for the deaf visited by the Delegation was on cure and training in spoken language, but both finger spelling and the older Chinese sign language were also used. The major treatment administered is acupuncture, which is reported to improve hearing from 50 to 60 percent.

The Chinese communist policy toward national minorities in China encourages the development of all aspects of national minorities' language and culture. Autonomous districts have been formed in areas inhabited by minority peoples and all state institutions in these autonomous regions use local minority languages in their dealings with the people. The National

Publishing House in Peking publishes books in the five major national minority languages: Mongolian, Uighur, Tibetan, Zhuang, and Korean, and many books, periodicals, and newspapers are published in the minority languages in the autonomous regions. The government also encourages the development of the national minority languages in two important ways—language standardization and orthographic reform—with the ultimate goal the conversion of all national minority scripts to romanization.

Research on the nature and structure of language as a goal in itself is not being pursued in China. There are no linguistic courses, nor departments of linguistics. Instead, linguistics is integrated into other courses and all linguistic work appears to be directed to areas that have immediate practical and political applications. As the Delegation's report suggests throughout, "linguistics is practiced for its social utility. Any sphere of linguistics which does not seem to have immediately practical ends at present is put in abeyance. In the foreseeable future then advances in theoretical linguistics, in psycho- and neurolinguistics, in typology and historical linguistics will have to be sought elsewhere."

ANALYSIS AND OPERATIONS RESEARCH: A TOOL FOR POLICY AND PROGRAM PLANNING

Use of systems analysis by the most advanced of the developing countries is expanding as the demands for planning at various levels and in different sectors become more complex and highly trained personnel and facilities, such as computers, become more available. Though elements of a systems analysis capability are beginning to be present in an increasing number of countries, the effective use of such internal resources remains limited, and local needs continue to be met substantially by foreign consultant services. There is growing interest among many of these countries, however, in building up indigenous analytical capabilities and in applying them to a widening range of problems. International aid agencies are actively fostering this demand by their insistence on receiving well-formulated project proposals that assure effective use of external resources within a framework of sectoral planning.

As a result, AID asked BOSTID to study the feasibility and character of a technical assistance program aimed at strengthening the systems-analysis capabilities of developing countries. AID and development specialists view systems analysis as an important methodological tool with which developing countries are inadequately proficient. A significant number of these countries are at a point in their development where local competence can be institutionalized, and where a high level of self-reliance can be achieved.

The study encompasses the following subject areas with recommendations as appropriate: (1) Exposition of systems analysis methodology and its lim ations, with emphasis on the planning aspects and the practical nature of the results sought; (2) Illustrative applications of systems analysis in public- and private-sector decision making, with particular reference to the problems and needs of the less developed countries (LDC); (3) Requirements for establishing and operating a systems analysis group and variety of organizational modes suited to LDC conditions; (4) Training processes and criteria for producing competent systems analysis personnel; and (5) Technical assistance implications and opportunities for AID.

The BOSTID panel that conducted the study found that systems analysis and operations research (SA/OR) is a demonstrated technique for assisting administrators and decision makers, and is of particular value when limited resources must be used to maximum effectiveness. Furthermore, the panel found that its application is within the reach of most developing countries where it can be developed and carried on by local scientists and technicians. It suggested that the industrialized countries assist with the training of such personnel and with the development of the operation. The panel pointed out, however, that systems analysis and operations research is not a panacea for the problems of the less developed countries; its limitations must be taken into account.

The summarized recommendations of the panel for the attention of the developed countries are:

1. Set up a prototype SA/OR group that will report to an administrator committed to its success.
2. Exercise caution in selecting specialists as advisers, using competitive sources and the advice of experienced SA/OR practitioners.
3. Encourage university courses in the practice of SA/OR and related subjects.
4. Sponsor conferences to familiarize business and government executives with SA/OR.
5. Sponsor scholarships, at home or abroad, for potential SA/OR practitioners.

The panel directed several recommendations to the attention of agencies providing assistance to less developed countries. A brief summary of these recommendations follows:

1. Encourage the formulation of integrated project plans based on SA/OR study.
2. Provide funding for scholarships and fellowships in SA/OR.
3. Assist in the promotion of national and regional conferences on the theory and application of SA/OR.
4. Give support to local and regional SA/OR societies.
5. Give direct support to selected SA/OR projects and programs.

PART III: SUMMARY REPORT, INSTITUTE OF MEDICINE

COMPLETED ACTIVITIES

MEDICARE-MEDICAID REIMBURSEMENT POLICIES

The results of a two-year study of Medicare-Medicaid payments to physicians in teaching hospitals, and the effects of those payments on the specialty and geographic distribution of physicians and on the supply of foreign medical graduates, were published in March 1976. The work of the study committee, chaired by Adam Yarmolinsky, LL.B., was supported by a contract with the Department of Health, Education, and Welfare. Recommendations of the steering committee included: establishment of three methods of reimbursement—cost, unified, and fee-based—to be incorporated incrementally; formation of a permanent, quasi-public, independent physician manpower commission to monitor the specialty distribution of physicians, and a moratorium on postgraduate specialty training slots, with the exception of family practice, general internal medicine, and general pediatrics; and the elimination of medicine as a designated shortage profession by the Department of Labor.

ANGLO-AMERICAN CONFERENCE ON CARE OF THE ELDERLY

A conference entitled "Care of the Elderly: Meeting the Challenge of Dependency" was held May 17–19, 1976, at the Academy headquarters in Washington. Experts in geriatrics and gerontology, providers of medical and social services, and public policy decision makers from the United States and the United Kingdom addressed the problems of dependency in old age and compared each country's current approaches to care of the elderly and proposed strategies for the future. Proceedings of the conference will be available in the fall. The conference was co-sponsored by the Institute of Medicine, the Royal Society of Medicine (London), and the Royal Society of Medicine Foundation, Inc. (New York), and was supported by the Administration on Aging, the National Institute on Aging, and the Florence V. Burden Foundation.

ACTIVITIES IN PROGRESS

CONTROLLING THE HOSPITAL BED SUPPLY

Publication of a policy statement on the supply of hospital beds in the United States is scheduled for August 1976. Robert Heyssel, M.D., is chairman of the steering committee. The policy statement will be an analysis of the current state of knowledge on the subject of hospital bed supply, an assessment of present plans and policies to ameliorate the problems, and the formulation of recommendations on the direction of future policy based on the foregoing analyses. The project is supported by Institute core funds.

PROGRAM IN HEALTH CARE ETHICS

The Andrew W. Mellon Foundation, in December 1974, granted the Institute $750,000 in core funds for the development of an expanded ethics program over a three-year period. The award has enabled the Institute to develop activities designed to examine the competing political, economic, and social values inherent in health policy decision-making. With the advice of a Committee on Social Ethics in Health, chaired by Edmund D. Pellegrino, M.D., a series of commissioned papers is being developed to address issues of ethical implications in such matters as resource allocation within medical care methods and between those and means of disease prevention, utilization of sophisticated technology to sustain life, public regulation of the supply and distribution of health manpower, and the disparities between patient expectations and provider behavior.

EVALUATION OF HEALTH CARE QUALITY ASSURANCE MECHANISMS

Authorized by Congress (P.L. 93–222), and contracted by the Department of Health, Education, and Welfare, this 14-month study is scheduled for completion in September 1976. Robert J. Haggerty, M.D., is chairman of the steering committee. The study will be an assessment of current knowledge and approaches to quality assurance mechanisms. Specific attention has been given to cost and cost effectiveness of quality assurance programs, the approaches to monitoring quality in long-term care settings, the implications of quality assurance for involving patients in the assessment of their own care, the implications for provider behavior, and the potential for assessing outcomes. Ancillary to the study is an investigation to determine the validity of information on abstracts of hospital discharge records for use as baseline data in assessing effects of PSROs.

MANPOWER POLICIES FOR PRIMARY CARE

This is a two-year study supported by core funds from the Robert Wood Johnson and W. K. Kellogg Foundations. E. Harvey Estes, M.D., is chairman of the steering committee which, based on the analyses of the functions of the primary care system and the roles of health care personnel in the delivery of primary care services, will develop recommendations for public actions that can guide the development of a manpower supply for primary health care.

ROBERT WOOD JOHNSON HEALTH POLICY FELLOWSHIPS

This program, established in 1973 with a grant from the Robert Wood Johnson Foundation, provides a year's study and congressional working assignments in Washington for six mid-career professionals selected annually from academic health centers in nationwide competition. The second class of Fellows arrived in September 1975 for orientation sessions arranged by the Institute. In December, they assumed full-time assignments for nine months in offices of both houses of Congress. The program is designed to develop policy-knowledgeable faculty members who can return to their health professional schools and foster an awareness of government health activities throughout the faculties.

THE ADMINISTRATION'S 1977 BUDGET: THE HEALTH BUDGET

This year's annual staff paper compares the President's 1977 budget recommendations with those adopted by the Congress in May 1976 to guide its appropriation and revenue committees. The paper, to be published in August, compares the budgets of the President and the Congress in relation to the impact on the economy, long-range projections, and on the major health programs.

NEW PROJECTS

STUDY OF MEDICAL INJURY COMPENSATION

The Institute has received support from the W. R. Hewlett and Henry J. Kaiser Family Foundations to conduct an 18-month study of existing and proposed types of medical injury compensation mechanisms. Based on analyses of such mechanisms, the steering committee, chaired by John R. Hogness, M.D., will develop recommendations for long-term solutions for the problems of medical injury compensation. The study is scheduled for completion in October 1977.

STUDY OF THE RELATIONSHIP OF TECHNOLOGY TO THE PRODUCTIVITY AND EFFECTIVENESS OF HEALTH CARE SYSTEMS

For this project, funded by the National Science Foundation, the Institute will cooperate with the NRC Assembly of Engineering in an examination of the uses and limits of technology in improving the productivity and effectiveness of health care systems. A steering committee, chaired by Dr. Jordan J. Baruch, has been appointed to oversee the study.

FEE SCREEN ANALYSIS

Additional analyses of the data obtained for the Study of Medicare-Medicaid Reimbursement Policies will be conducted at the request of the Social Security Administration. For this activity, the Institute will examine the relationships between physician fees and payment levels of Medicare-Medicaid and commercial insurers, fee patterns and related variables in five metropolitan areas, fee levels and patterns of Medicaid utilizations in three states, cost implications of nationwide fee schedules, and fee patterns and payment levels in underserved versus non-designated underserved areas. Reports in each area of analysis will be completed in March 1977.

COSTS OF GRADUATE MEDICAL EDUCATION

Utilizing data obtained for the Social Security Studies and the Costs of Medical Education Study, the Institute will develop alternative models for defining and measuring the costs of graduate medical education. Issues to be considered include the degree to which house officers are students as against being providers of care, and the extent to which teaching hospital costs should be ascribed to education as opposed to patient service. A March 1977 completion date is projected.

RE-ABSTRACTING STUDY OF MEDICARE DISCHARGE RECORDS

This study will be conducted for a period of six months under the guidance of the steering committee for the Study of Health Care Quality Assurance Programs, chaired by Robert J. Haggerty, M.D. This activity will be an analysis of the reliability of information which reflects the utilization of health services by Medicare beneficiaries.

PART IV: SUMMARY REPORT, NATIONAL RESEARCH COUNCIL

ASSEMBLY OF BEHAVIORAL AND SOCIAL SCIENCES

The Assembly's activities are grouped under three program areas: (1) developing the behavioral and social science disciplines; (2) increasing the utilization of the behavioral and social sciences in public policy formation; and (3) improving the understanding of social processes and problems. Studies either completed by the Assembly in the past year or underway as of June 30, 1976, are summarized below:

PROGRAM AREA I

COMMITTEE ON THE SOCIAL SCIENCES IN THE NATIONAL SCIENCE FOUNDATION

During the last ten years, the National Science Foundation (NSF) has become a major source of support for both basic and applied research in the behavioral and social sciences. The NSF program of fundamental research in the social sciences is the only federally supported program designed to enlarge the base of understanding across the spectrum of the behavioral and social science disciplines. In carrying out a review of its research support programs and assessing the role of the social sciences in particular, NSF requested that the National Research Council formulate recommendations on priority areas for support in the social sciences and identify the means to increase the vitality and productivity of NSF's over-all research program in the social sciences. The Committee transmitted an interim report to the National Science Foundation in February 1976 and a final report in July 1976.

FUNDAMENTAL RESEARCH RELEVANT TO EDUCATION

At the request of the National Institute of Education (NIE), the National Research Council, in cooperation with the National Academy of Education, has undertaken a broad study of fundamental research relevant to education. This study will assess current fundamental research on the scientific foundations of education, the role of NIE and other federal agencies in supporting fundamental research, and possible changes in policy relevant to fundamental research that might be considered by the National Council on Educational Research of NIE or other government bodies. The report of this Committee is due in the spring of 1977.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF THE HISTORY AND PHILOSOPHY OF SCIENCE

This Committee provides appropriate U.S. participation in the International Union of the History and Philosophy of Science in the areas of the history of science, the methodology and philosophy of science, and logic. Representatives of the U.S. National Committee attended the Vth International Congress of Logic, Methodology, and Philosophy of Science, held in Canada in 1975. The Committee will assist in organizing and designating delegates and alternates to the XVth International Congress of the History of Science, to be held in Edinburgh, Scotland, in 1977.

PROGRAM AREA II

STUDY PROJECT ON SOCIAL RESEARCH AND DEVELOPMENT

Serious reservations have been expressed by government officials and members of Congress about the quality of federally supported social research and development and the limited value of even competently performed R&D in the formulation of social policy. The Study Project on Social R&D was established to examine the content, organization, and management of social research and development and to recommend improvements. Studies have been carried out that examine a wide range of topics, including: the organization and management of social R&D related to several problem areas and target groups; management processes, including grants and contracts policies, the definition of projects, and the selection of performers; the use of social R&D in policy-making; strategies for the support of social science inquiry; the organizational setting and funding of outstanding policy research projects identified in NSF-sponsored syntheses of such research; and the use of econometric and demographic methods to forecast emerging social problems as a basis for planning programs of research.

COMMITTEE ON VOCATIONAL EDUCATION RESEARCH AND DEVELOPMENT

This Committee was formed in 1974 to review and assess the vocational education research and development program of the Office of Education since 1963 and to provide recommendations for the future content and management of that program.

The Committee's final report, to be published in the summer of 1976, focuses on the management and organization of the vocational education R&D system as well as an assessment of its R&D products. The report identifies promising research topics and recommends ways to improve the program and increase utilization of its products.

COMMITTEE ON DEPARTMENT OF LABOR MANPOWER RESEARCH AND DEVELOPMENT

The manpower research and development program of the Department of Labor has made significant contributions to policy formulation and scientific knowledge in the manpower field, but important substantive gaps still remain. That is the major finding in the Committee's report, *Knowledge and Policy in Manpower: A Study of the Manpower Research and Development Program in the Department of Labor,* published late in calendar year 1975. The Committee recommended that the Office of Manpower Research and Development (OMRD) establish a continuing fellowship program; place greater reliance on non-staff capabilities; establish an advisory committee to the Assistant Secretary for Manpower; and create mechanisms to obtain advice on R&D plans directly from state and local program officials.

COMMITTEE ON VISION—COMMITTEE ON HEARING BIOACOUSTICS AND BIOMECHANICS

These committees respond to problems concerning any aspect of vision or hearing, including engineering and equipment, the physics of light or sound, physiology of response, individual perception, and group or social response. The committees are supported by the three armed services, the Federal Aviation Administration, the National Aeronautics and Space Administration, the National Institute of Neurological and Communicative Disorders, the National Institute for Occupational Safety and Health, and the Environmental Protection Agency.

PROGRAM AREA III

COMMITTEE ON APPRAISAL OF SOCIETAL CONSEQUENCES OF TRANSPORTATION NOISE ABATEMENT

The Environmental Protection Agency (EPA) either has or shares a responsibility for setting noise standards for all types of motor vehicles. This NRC study is investigating the methodological problems and issues in assessing the consequences of alternative transportation noise standards including projections of future transportation use and its associated noise; technical issues in the monitoring and assessment of noise; the tradeoffs available in alternative strategies of noise control; the effects of noise on human health, performance, communication, and quality of life; alternative policy instruments for noise abatement; the income and geographical distribution effects of noise abatement procedures; and the feasibility and policy implications of proposed environmental actions.

This Committee, which was established in cooperation with the Building Research Advisory Board and the Transportation Research Board of the Commission on Sociotechnical Systems, is part of the over-all Academy project for the *EPA*.

COMMITTEE ON RESEARCH ON LAW ENFORCEMENT AND CRIMINAL JUSTICE

At the request of the Law Enforcement Assistance Administration (LEAA) of the Department of Justice, this Committee has undertaken two separate, but related, efforts in connection with the research program of the National Institute of Law Enforcement and Criminal Justice (NILECJ).

The first effort is to review the over-all program of research and development sponsored by NILECJ in order to make recommendations for increasing the impact and productivity of research and development in crime and corrections. The second is to develop a long-term agenda for research in the area of deterrence effectiveness.

COMMITTEE ON MEASUREMENT OF ENERGY CONSUMPTION: DATA NEEDS AND DATA DEVELOPMENT

Although various federal agencies have collected data on energy production and supply, relatively little systematic data have been collected on energy consumption, particlularly by end use, and on the factors that affect or influence energy consumption. This Committee was established in cooperation with the Committee on National Statistics of the Assembly of Mathematical and Physical Sciences, to provide advice to the Federal Energy Administration on energy consumption data needed for policy formulation and evaluation, and on methods for collecting these data.

COMMITTEE ON EVALUATION OF EMPLOYMENT AND TRAINING PROGRAMS

This Committee is examining the public administration and socioeconomic impacts of the Comprehensive Employment and Training Act (CETA), which decategorized and decentralized manpower programming. The major sources of data for the study are interviews conducted by 20 field research associates in a national sample of 28 areas. As a result of one sampling, an interim report, covering the structural and programmatic changes in manpower programs resulting from CETA, was completed in January 1976.

COMMITTEE ON ASSESSMENT OF DEMAND FOR OUTDOOR RECREATION RESOURCES

This study was undertaken in response to a request from the Bureau of Outdoor Recreation that the Academy undertake a broad assessment of the objectives, methods, and data requirements of alternative techniques of demand estimation. In its final report, *Assessing Demand for Outdoor Recreation,* which was published in October 1975, the Committee concluded that the assumption of a centralized comprehensive model for planning, when in fact outdoor recreation planning is decentralized among federal agencies, state and local governments, and private firms, has led to the use of inappropriate analytic approaches.

ADVISORY COMMITTEE ON CHILD DEVELOPMENT

This Committee was formed in 1971 at the request of the U.S. Office of Child Development (OCD) to: (1) review the combination of unmet needs and unrealized opportunities for child development up to age eight; (2) develop goals and essential features of an integrated national policy for child development; (3) assess the implications of scientific knowledge for public policy; and (4) make recommendations for new program initiatives both within OCD and in other federal agencies having responsibility for child development. The final report of this Committee will be published in the fall of 1977.

SUBSTANCE ABUSE AND HABITUAL BEHAVIOR

There is a growing realization that the two major problems of addiction in America, alcoholism and drug abuse, have much in common and that they bear important relationships to softer forms of addictive behavior, such as cigarette smoking, coffee drinking, overeating, gambling, working, etc. Up to now, however, each of these behaviors has usually been treated separately, both with respect to basic research on psychological and physiological processes and to treatment and preventive intervention strategies. A broader perspective on these issues—attempting to bring together the results of existing studies on psychological, physiological, and social dimensions of addiction in its various forms—is the next logical step.

With funding from the National Institute on Drug Abuse, this Committee has been established to provide, on a continuing basis, the following activities: (a) The synthesis and assessment of current knowledge regarding substance abuse and habit formation; (b) the development of agendas for future research—including the identification of high-priority areas; and (c) the identification of the likely implications of current and new knowledge for public policies relating to the prevention and treatment of addiction in its various forms.

PROPOSED PROJECTS

Projects that have been authorized during the past year, but for which funds had not been obtained as of June 30, 1976, include national facilities for social science research, U.S./U.S.S.R. cooperative social science research, the scientific status of voiceprints, methods of reducing the amount of energy used in illuminating work places, psychophysiology, regulatory processes, and alternative approaches to the transition from education to work. The Assembly is also developing projects for which authorization and funding will be sought; included are a study of the effects of shifts in U.S. migration, a Committee on Child Development Research and Public Policy, and a review of data and methods for assessing community reactions to the Concorde.

ASSEMBLY OF ENGINEERING

This Assembly brings to bear the resources of engineering knowledge, practice, method, and insight upon important national problems of modern technology and its inevitable impacts. Organized within the NRC in July 1974, the Assembly took over the study activities of the National Academy of Engineering and continues to work closely with the NAE, drawing on its membership whenever possible to engage in projects and to review reports.

In fiscal year 1975–76 the Assembly's program included studies of energy systems, seafloor engineering, the U.S. Navy's oceanographic future, the U.S. Postal Service's "electronic mail," urban telecommunications, aircraft fuel efficiency, supersonic flight research, transportation policy, technology transfer from foreign direct investment in the U.S., contracting practices in tunneling, stimulating minority students into engineering, and health care technology. Among the new activities undertaken within the Assembly are a study of safety and certification procedures for offshore energy and mining facilities, an assessment of ocean thermal energy conversion methods, U.S. technology impacts on world trade, and an evaluation of the Corps of Engineers' project for reusing water from the Potomac River Estuary in the Washington, D.C., metropolitan region. During the year, the Air Force Studies Board was transferred to the Assembly from the Assembly of Mathematical and Physical Sciences and the Board on Engineering Manpower and Education Policy was discharged at the completion of its task.

AEROSPACE ENGINEERING AND APPLICATIONS

The Aeronautics and Space Engineering Board was established in 1967 to provide analytical advice to federal agencies on policies, plans, and projects in order to advance the state of areospace engineering. In its capacity as adviser to the National Aeronautics and Space Administration, the ASEB last year sent the agency five letter reports—most notably one urging the NASA to accelerate its application of composite materials to aircraft engines and airframe structures as a significant way of increasing durability and decreasing fuel consumption, another recommending new research into reviving and improving turboprop airplanes as a means of conserving fuel in passenger and cargo transport, and a third proposing that the NASA intensify its research on supersonic flight, in particular, by developing an engine that is economic, with low pollution emissions and noise levels.

Activities of the Space Applications Board, formed in 1972 to advise the NASA on the feasibility of space technology to meet relevant national needs, continued to follow up its 1974 summer study. The report of this study, *Practical Applications of Space Systems,* delivered to the NASA in June 1975, drew largely from the work of 14 panels. In the first half of fiscal year 1975–76 the supporting papers by these panels were published, covering a range of topics such as weather and climate monitoring and forecasting, land use planning, environmental protection, water and mineral prospecting, and information services. One of the recommendations led to an SAB study, at the request of the NASA, into the ways the agency could develop a research and development program in satellite communications. The SAB is coordinating this work with the Assembly's Committee on Telecommunications and expects to publish its report in late 1976.

Since 1962, the Air Force Studies Board has devoted its efforts, at the specific request of the U.S. Air Force Systems Command, to such subjects as flight dynamics, propulsion and electronic systems, materials and structures, and air and space vehicles. During the past fiscal year, the Board's Panel on Technological Tradeoffs issued a report, *Reliability in Aeronautical Avionics Systems,* which found the Air Force deficient in managing the design and acquisition phases of its sophisticated airborne electronics, in contrast to the experience of the commercial airlines in purchasing and using solid-state systems in flight. The Propulsion Panel issued a classified report, *Transonic Axial-Flow Compressor Configurations for Aircraft Propulsion Systems.* The Board has other panels studying the technology of command, control, and communications, reviewing the problems of developing a plastic windscreen for the supersonic F/FB–111, and planning a three-week summer study on operational software management and development.

COMMUNICATIONS

The Committee on Telecommunications was formed in 1968 to provide analyses and guidance to seven federal departments or agencies, collectively and individually, on matters concerning telecommunications-information systems and their applications in society. The present federal consortium consists of the departments of Commerce; Health, Education, and Welfare; Housing and Urban Development; and Transportation; and the Federal Communications Commission, National Science Foundation, and U.S. Postal Service.

Throughout this fiscal year the committee has engaged in the first half of a two-year study of metropolitan telecommunications systems for the early 1980s. In the course of its examination, the committee has surveyed such existing facilities as the telephone, mobile radio, cable TV, satellite communications, and computer and terminal equipment that are in use or could be applied to improve the operation of urban regional governments and help the disadvantaged, aged, sick, and under-educated in the community. While a report on this phase of the study will be issued early in the next fiscal year, the second phase, concerned with the development and application of new technology for the period 1980–90, will continue.

Since 1974, a special panel of the committee has evaluated a program developed by HUD to implement various computer-based information-communications systems for improving the management and operation of governments in five test cities—Charlotte, N.C.; Dayton, Ohio; Long Beach, Calif.; Reading, Pa.; and Wichita Falls, Tex. After releasing its report, *Local Government Information Systems*, the panel was asked by HUD to enlarge upon the principal recommendation—that an information systems resource center needs to be established to provide assistance to local governments in the use of computer-information technology. A report responding to HUD's request was prepared for publication early in the next fiscal year.

Another panel of the committee devoted the year to a study of electronic message distribution—more commonly called "electronic mail"—for the U.S. Postal Service. The panel found that while telecommunications technology has altered human communication more radically than anything since Gutenberg's printing press, the nation's postal system has neglected this development, except for a joint venture with Western Union in "Mailgram." The report of this study will be published in the fall of 1976.

ENERGY

Early in 1975 the Energy Research and Development Administration requested that the Academies examine the benefits and risks of nuclear power systems, including the proposed breeder reactors, and weigh these against the options, both available and anticipated, for meeting the nation's energy needs between 1980 and 2010. An NRC-wide study, engaging some 200 scientists, engineers, educators, industrialists, lawyers, bankers, and others, the Committee on Nuclear and Alternative Energy Systems is administered by the Assembly.

This study will come to grips with a broad range of important questions regarding supplies, demands, conservation practices, economic costs, environmental consequences, foreign policy implications, and such human factors as health, safety, equity, and life-styles. In the first stage of its deliberations, the committee held public hearings in five cities—New York, N.Y.; Atlanta, Ga.; Minneapolis, Minn.; Denver, Colo., and San Francisco, Calif.—to enable concerned individuals and organizations to raise issues on such questions and comment on the study plan. In all, 98 people appeared before members of the committee at these hearings and 57 others submitted written statements or papers. Four assessment panels (Supply/Delivery, Demand/Conservation, Risk/Impact, and Synthesis) will submit reports to the committee, and a final report by the committee will be delivered to the ERDA, Congress, and the public in June 1977.

Even before this study began, the Assembly established the Energy Engineering Board to develop and maintain a base of energy knowledge and to analyze specific technical subjects related to energy. This Board conducted a planning conference to initiate the ERDA study and formed an ad hoc Committee on Drilling Technology for Energy Resources to develop an R&D strategy for increasing the exploration and production of underground energy sources. The study, supported by the ERDA, Department of the Interior, and the NSF, resulted in publication of *Drilling for Energy Resources.* The Board also organized another study for the ERDA on the potential for advanced energy storage systems. Although a report of this work, entitled *Criteria for Energy Storage R & D,* will be published in the fall of 1976, the Committee on Advanced Energy Storage Systems has undertaken to examine in the next two fiscal years how such technology can be usefully applied to various potential users.

EDUCATION AND PUBLIC POLICY

The Board on Engineering Manpower and Education Policy, formed in 1974 as a successor to the NAE's Commission on Education, completed its work on a long-term activity by publishing its report, *Computer Aids for the Chemical Engineering Education Project.* The Board was disestablished at the end of the fiscal year.

Another educational activity, initiated by the NAE in 1974, was the Committee on Minorities in Engineering. Supported by some 35 of the nation's largest corporations and foundations, this committee provides studies, advice, coordination, and leadership for approaches best calculated to increase the proportion of four particularly disadvantaged minorities—Blacks, Chicanos (Mexican Americans), Puerto Ricans, and American Indians—in the engineering profession. The committee has prepared a "master plan" for attaining parity representation of these minority groups for the Class of 1985 in engineering schools. During the fiscal year it has issued three publications, *Building Effective Minority Programs in Engineering Education, A Selected Annotated Bibliography on Employment of Minority Engineers,* and *Proceedings of a Workshop for Program Directors in Engineering Education of Minorities.*

In the last fiscal year the committee helped to establish a scholarship fund for minority students in engineering, which now operates independently. The committee continues to advise national, regional, and local institutions and organizations that support engineering education programs for minorities. One example of this activity is its work with coalitions of high school educators, community groups, local industry, and others in Chicago and Cleveland to advance career guidance and academic needs of minority students interested in becoming future engineers.

In its capacity as a research unit, the committee has initiated studies on retention to identify the factors leading to traditionally high dropout rates among minority students and the approaches for correcting that problem and on government policies and resources devoted to supporting minority groups in engineering schools. These studies, which are coordinated with the Commission on Human Resources, will result in published reports in the next fiscal year.

Another Assembly activity under the rubric of Education and Public Policy involves the Committee on Public Engineering Policy. Established in 1967, this committee has brought to bear the knowledge and experience of engineering on such serious and timely problems as air pollution and food production and distribution. In addition, the committee has studied the relationship of technology to government policymaking, the methods of improving the management of technology to serve the changing needs of society, and the broad question of relating science and technology to national policies. In pursuing its studies, COPEP has engaged many disciplines and professions, including engineering, economics, behavioral and social science, ecology, industry, public administration, and international affairs. During the fiscal year, COPEP completed a study for the NSF's program of Research Applied to National Needs (RANN) and its report, *Alternative Management Strategies for Applied Research*, will be published in the fall of 1976.

HEALTH CARE TECHNOLOGY

In the current debate over a national health care program, better understanding of the benefits and risks of technology is important because of the increasing costs and demands for medical services likely to result if a program is adopted. In June 1976, accordingly, the Committee on Technology and the Health Care System was established by the Assembly in cooperation with the Institute of Medicine to study the uses and limits of technological innovation in health care. This 12-month study, supported by the NSF, seeks to formulate a balanced set of research strategies and policy recommendations for decision makers in the governmental and private sectors.

INTERNATIONAL IMPACTS

The seminar on "U.S. Technology and International Trade," held in connection with the annual meeting of the NAE in April 1975, spotlighted a critical public policy issue: During the past 20 years there has been a radical change in the relative position of the United States with respect to its technological capabilities within the world economy. The present state of U.S. technology, while much more advanced and intensive than technology in any other country, causes apprehension for the future, as do numerous economic and social indicators—the decline in productivity of both workers and capital, the deterioration in foreign trade balances, and the disenchantment with technology as the best way of improving the quality of life.

Recognizing the importance of the issue, the Assembly, in cooperation with the NAE, established a Committee on U.S. Technology and International Trade for the purpose of conducting a workshop to identify the technological factors contributing to the nation's foreign trade position and domestic socioeconomic development. At the same time, the Department of Commerce and the NSF, in response to a request from the Congress under the Foreign Investment Study Act of 1974 (Public Law 93–479), asked the Academies to conduct a study of direct foreign investment in the U.S. Accordingly, the committee, operated jointly by the Assembly and the NAE's Office of the Foreign Secretary, held four one-day seminars in New York City, February 2–5, 1976, to examine how foreign direct investment in four important U.S. industries (petrochemicals, pharmaceuticals, non-electrical machinery, and electronics, computers, and scientific instruments) affects the transfer of technology into and out of the country. The report of this seminar, *Technology Transfer from Foreign Direct Investment in the United States,* was published by the NAS and as an appendix to the Department of Commerce report, *Foreign Direct Investment in the United States.*

Once this project was completed, the committee returned to its original study plan, preparing for a summer workshop at Woods Hole, Mass. A report on the study will be published by the end of 1976.

OCEAN AND WATER RESOURCE ENGINEERING

The Marine Board was organized in 1970 to enlarge the purpose and work of the NAE's Committee on Ocean Engineering, which had been established in 1965. Its responsibilities include reviewing the state of the art and applying engineering knowledge and experience to such concerns as ocean resources and ocean policies, both domestic and international. The Board serves as the U.S. National Committee for the International Engineering Committee on Oceanic Resources (ECOR). During the year, a special panel of the Board issued its fourth report to the U.S. Geological Survey on the safety of offshore petroleum recovery. Another panel completed a study on *Waste Management for the Coastal Zone—Concepts for the Assessment of Ocean Outfalls,* a report that evaluates the rationale for setting federal standards to protect the coastal environment. Still another panel produced a report for the U.S. Navy entitled *Underwater Electrical Safety Practices,* which compares the Navy's underwater cutting and welding operations with those in the commercial diving industry.

In addition, the Board assessed the capabilities, operations, and utilization of the National Oceanographic Instrumentation Center and reviewed the program of the Manned Undersea Science and Technology Office of the National Oceanic and Atmospheric Administration to determine how it responds to the needs of the nation and, particularly, civil users and whether or not it can support the expected requirements for underwater facilities. A study of the national needs, technical capabilities, and research requirements for seafloor engineering was a major activity of the Board in the past two years. Supported by the NSF, this study resulted in the publication of two volumes of background papers, *National Needs in Seafloor Engineering* and *State-of-the-Art in Seafloor Engineering*, which served as source documents for the group's final report, *Seafloor Engineering: National Needs and Research Requirements.*

The Board's principal study, made for the U.S. Navy in cooperation with the Ocean Sciences Board of the Assembly of Mathematical and Physical Sciences, was an analysis of the science and technology R&D considered vital to support the Navy's projected mission between 1980 and 2000. This culminated in a final classified report, *Directions for Naval Oceanography.*

Projects that the Board will continue in the next fiscal year include, for the USGS, a study of criteria for the proposed certification by the federal government of the design, construction, installation, and operation of offshore structures; a review of the technical and economic feasibility of presently known ocean thermal energy conversion systems; an assessment of the technological needs by the federal government and commercial sector, with an analysis of the economic, jurisdictional, and environmental factors, for mining minerals from the seafloor; and participation in an evaluation by the Environmental Studies Board of the Commission on Natural Resources of the Bureau of Land Management's Environmental Studies Program, in particular the ecological consequences of oil and natural gas exploration and recovery along the outer continental shelf.

The Board participates in two other joint activities in international ocean matters: It has member representation with the Ocean Sciences Board on the ad hoc Panel on the International Decade of Ocean Exploration, which advises the NSF on long-term programs of ocean exploration and research, and on the Ocean Policy Committee of the Commission on International Relations, which advises federal agencies, inter-agency groups, and other organizations on issues of national and international marine policies, ocean pollution, technical assistance, and fishery development.

Under Public Law 89-298, the Corps of Engineers is required to request that the National Academy of Sciences-National Academy of Engineering review (1) the scientific basis for conclusions reached by the Corps in its examination of the future water resources needed by the Washintgon, D.C., metropolitan area and (2) the planning, contracting, and testing of a pilot water treatment plant designed by the Corps to determine the feasibility of using the Potomac River Estuary as a source of drinking water for the Washington, D.C., region. During the last part of the fiscal year, the Assembly has organized an ad hoc committee, housed for administrative purposes in the Marine Board, to deal with the seven-year evaluation of the pilot treatment facility. Early in the next fiscal year it will form an interrelated ad hoc committee to study the first part of the Congressional charge to the Corps.

TRANSPORTATION

Since 1970, the Committee on Transportation has been reviewing and evaluating national transportation needs and programs as well as major advances in transportation technology. In this fiscal year it issued *Review of Short-Haul Passenger Transportation,* a report of high-speed, heavy-rail passenger systems for intercity corridors, which had been based on a 1974 summer workshop at Woods Hole, Mass. It also reviewed for the Department of Transportation the Automated Guideway Transit (AGT) program, which covers a broad range of systems using unpiloted vehicles, with capacities varying from 1 to 2 and up to 100 passengers, and operating on fixed guideways along exclusive rights of way. The committee found that, considering the cost and unreliability of today's systems, there is not now a large market for such technology. Both of these studies were supported by the Department of Transportation.

In addition, the committee and DOT jointly conducted a workshop at the NAS Building on priorities for university research in transportation in order to assist the DOT in devising plans and policies for its university research program. Proceedings of this workshop will be published in the next fiscal year.

A related activity is the Bay Area Rapid Transit (BART) Impact Advisory Committee, which provides analysis of the social, behavioral, economic, political, and physical effects of the system on the San Francisco regional community. Since 1972, the committee has been evaluating a continuing study of such impacts made by the Metropolitan Transportation Commission, the regional planning agency in the San Francisco Bay area, under the sponsorship of the DOT and HUD and the State of California. At the end of the fiscal year, the committee, sponsored by the DOT, was preparing a report on the federal policy implications of the BART review and a research design for a later stage of the impacts study.

TUNNELING TECHNOLOGY

The U.S. National Committee on Tunneling Technology was organized in 1972 for the purpose of stimulating advances in the state of the art and coordinating information on R&D, technology, training, contracting, and other aspects of underground tunneling in the U.S. and elsewhere. During the fiscal year, the committee has participated in the activities of the International Tunneling Association, assisted the DOT and University of Illinois in organizing a short course for faculty members from U.S. universities offering curricula in geotechnical engineering and tunneling, and completed a set of case histories for presentation, at the request of the DOT, in a series of briefings on developing better contracting practices for the construction of urban transportation facilities. *Standardization and Metric Conversion for Tunneling, Underground Construction, and Mining,* the proceedings of a symposium held in May 1974, was published this fiscal year.

ASSEMBLY OF LIFE SCIENCES

Although most of the activities of the Assembly are lodged in either the Division of Medical Sciences or the Division of Biological Sciences, a few deal with subjects that are neither primarily medical nor biological. These special activities are under the direct supervision of the Assembly's Executive Director.

COMMITTEE ON HEALTH CARE RESOURCES IN THE VETERANS ADMINISTRATION

The Veterans Health Care Expansion Act, signed into law in August 1973, directed the Administrator of the Veterans Administration (VA) to enter into an agreement with the National Academy of Sciences to conduct an extensive review and appraisal of resource requirements in VA medical facilities. In May 1974, the Committee on Health Care Resources in the Veterans Administration began work on 15 studies, most of which are nearing completion.

The project includes cohort studies on access to and quality of medical, surgical, and psychiatric care in 18 VA facilities; a study of hospital staffing and the quality of nursing care in acute bed sections; a survey of veterans in selected geographic areas to determine patterns of VA health care utilization and the factors that stimulate and inhibit the use of VA health care; a survey of VA staff; studies of affiliation relationships between medical schools and VA hospitals; dental care; ambulatory/outpatient care; and utilization and cost; an assessment of potential sharing relationships between VA and non-VA hospitals; studies of long-term care, rehabilitation medicine, VA medicine, surgery, and psychiatry; and site visits to selected VA hospitals by teams of professional consultants.

COMMITTEE ON TOXICOLOGY

The Committee suggests studies and receives requests for advice and assistance from the Air Force, Army, Navy, Consumer Product Safety Commission, Environmental Protection Agency, Energy Research and Development Administration, Federal Aviation Administration, and National Aeronautics and Space Administration. It considers matters of broad agency policy involving toxicology, recommends interim environmental exposure standards, suggests specific toxicology testing or research, and advises on and participates in field studies on toxicity problems.

Established under the Committee are Subcommittees on Fuels, Fuel Additives, and Their Combustion Products; Fire Toxicology; Lead in Paint; Inhalation Toxicity; Behavioral Toxicology; Chronic Toxicity; Dermal and Eye Toxicity; Ingestion; Mutagenesis; and Reproduction and Teratogenesis; as well as a Subcommittee to Revise the Publication "Principles and Procedures for Evaluating the Toxicity of Household Substances" (NAS Publication 1138).

COMMITTEE ON SAFE DRINKING WATER

The Safe Drinking Water Act (PL 93–523) of 1974 requires the Administrator of the Environmental Protection Agency to promulgate national drinking water standards and directs him to arrange with the National Academy of Sciences for a study of the adverse effects on health attributable to contaminated drinking water. The Committee on Safe Drinking Water was subsequently established to conduct the study.

The Committee is reviewing the scientific basis for estimating quantitatively the adverse effects on health of the known impurities in drinking water and the prospect of new kinds of contaminants, and will make recommendations and set relative priorities for new research to close gaps in knowledge that make it difficult or impossible to settle the related questions of public health.

The work of the study is divided among ten subcommittees. Eight subcommittees are studying specific classes of contaminants found in drinking water: particulates (asbestos and other finely divided solids), radioactivity, "special" ions (sodium, nitrate, sulfate, fluoride), trace metals, metalloids (arsenic, selenium), pesticides, organics, and microbiology. A Subcommittee on Margin of Safety and Extrapolation has been formed to estimate the probable effects of low doses of impurities on man over long periods of time. The Subcommittee on Morbidity and Mortality is studying the extent to which the harmful contaminants in drinking water may affect the incidence of disease, death rates, and the related problems that may be experienced by particularly susceptible people.

NATIONAL CENTER FOR TOXICOLOGICAL RESEARCH PROGRAM REVIEW COMMITTEE

The National Center was established in 1972 at the recommendation of the Secretary of Health, Education, and Welfare. It is charged with investigating experimentally the low-dose end of the dose-response curve for carcinogenic chemicals and with developing new methodology for toxicology testing. Before funding extensive new programs, the House Appropriations Committee for Agriculture, Environmental, and Consumer Protection called for a review of the scientific program of the National Center. The Commissioner of the Food and Drug Administration requested the National Academy of Sciences to conduct the review, and the Program Review Committee was established. An interim report has been prepared.

COMMITTEE ON THE RADIATION EFFECTS RESEARCH FOUNDATION

The Committee was formed in 1975 to give program advice to the National Academy of Sciences with respect to the Radiation Effects Research Foundation (RERF). RERF, a private non-profit foundation, is the successor to the Atomic Bomb Casualty Commission (ABCC), a former field agency of the Academy charged with determining the late effects of radiation from the atomic bombs on the exposed populations of Hiroshima and Nagasaki . RERF is governed by a Board of Directors, half from Japan and half from the United States. The Board receives scientific advice on the RERF program from a Science Council composed of Japanese and U.S. scientists.

The RERF continues the practice established by ABCC of publishing its research results in Technical Reports, and at the recommendation of the Science Council has undertaken an investigation, at the biochemical level, of mutations that may have been caused by radiation from the bombs.

COMMITTEE ON PROSTHETICS RESEARCH IN THE VETERANS' ADMINISTRATION

This Committee was organized in response to a request from the Veterans' Administration (VA) for an independent evaluation of the research and development programs of prosthetics research in the VA. The Committee was asked to examine the scientific merits of individual projects and of total programs in terms of priorities, relevance, and productivity, and to recommend areas and priorities for future research.

The Committee's report, which is nearing completion, will analyze the current research program, the organization and administrative mechanisms for initiating and reviewing grants, and the communication channels for disseminating the results of studies.

COMMITTEE ON THE PROPOSED LEGISLATION TO RESTRUCTURE THE FOOD AND DRUG ADMINISTRATION

In November 1975, Senators Edward M. Kennedy (D.-Mass.) and Jacob K. Javits (R.-N.Y.) asked NAS President Handler to provide the Academy's views on Senate Bills S. 2696 and S. 2697, and "to develop alternate proposals, if appropriate." This Committee was formed in February 1976 to study these bills and to advise Dr. Handler.

In the report submitted to Dr. Handler in April 1976, the Committee emphasized that the FDA finds itself in a difficult position as it exercises judgments on risk/benefit questions. Because the concept of "safety" is poorly understood and exact standards do not exist, judgments made by the FDA can easily be criticized as too restrictive or too lax.

The basic recommendations contained in the Committee's report are: (1) That the FDA not be divided into two agencies (a Drug and Devices Agency and a Food and Cosmetics Agency) as proposed in the legislation; (2) that FDA personnel policies be modified to encourage personnel interchanges with more flexibility than provided in the proposed legislation; (3) that a fourth drug evaluation phase (phase D) to provide for "broad but carefully controlled" distribution of a drug before final approval is given for full marketing not be mandated; (4) that a National Drug Review Board not be mandated; and (5) that the freedom of physicians to prescribe drugs not be unreasonably restricted.

Division of Biological Sciences

COMMITTEE TO EVALUATE THE INTERNATIONAL BIOLOGICAL PROGRAM

The Committee submitted its report to the National Science Foundation in January 1976. The Committee judged the overall U.S. effort in the program to be creditable and concluded that substantial scientific contributions were made. The report describes the development of the program and management of its various components, information storage and handling, national and international impacts of the US–IBP, evaluates accomplishments, and makes suggestions to guide future planning.

COMMITTEE ON BIOLOGY OF PEST SPECIES

The Committee is planning a symposium on "Birds as Pests," to be held late in 1977 or early in 1978. The symposium will recognize the following issues: economic losses in agriculture, aircraft hazards, fire hazards, disease, urban nuisance, aesthetic considerations, and existing and potential methods of control, but will deal primarily with the biology of birds in relation to why, how, and where they become pests, rather than addressing control measures.

The Committee also plans to direct its attention to the potential use of insect viruses (baculoviruses) as control agents.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF BIOLOGICAL SCIENCES (USNC/IUBS)

Because the permanent secretariat of the Union in Paris has materially enhanced the effectiveness of IUBS operations, the Committee agreed that it must be maintained. Nominations of Dr. Oker-Blum (Finland) as President and Dr. Edward S. Ayensu (USA) as Secretary General of the Union were reaffirmed and the Secretariat so notified.

Delegates to the XIX General Assembly to be held in Bangalore, India, during September 27-October 1, 1976, are: Kenneth V. Thimann, Chairman, Edward S. Ayensu, Rita Colwell, John A. Corliss, and John A. Moore. An ad hoc committee was formed to coordinate suggested symposia for a forthcoming zoological congress and to recommend future activities of the Division of Zoology, IUBS. In addition, the Committee decided to support a travel grants program for the XVII International Ornithological Congress, Berlin, June 1978, and a similar program for the XV International Ethological Congress, to be held in Germany in 1977.

U.S. NATIONAL COMMITTEE OF THE INTERNATIONAL UNION FOR PURE AND APPLIED BIOPHYSICS (USNC/IUPAB)

The Committee serves as the focal point for interaction between the U.S. scientific community and IUPAB. It sponsored a travel grants program for the August 1975 V International Biophysical Congress in Copenhagen, and later reviewed the reports of the attendees. Significant actions of the VI General Assembly that had been proposed and supported by the U.S. delegation were: upward revision of the Union dues in each category; a change in the Statutes to establish two vice presidents; and the establishment of a new Commission on Education and Development in Biophysics.

The Committee has voted to propose a travel grants program for the VI Congress in Kyoto, Japan, in 1978.

U.S. NATIONAL COMMITTEE OF THE INTERNATIONAL UNION OF NUTRITIONAL SCIENCES (USNC/IUNS)

The Committee recommended to the IUNS Council that planning should begin two congresses in advance, that a set of guidelines for national membership categories—based on natural resources and relative efforts in nutritional sciences—be adopted, and that a study be made of the funding and opportunities involved with the establishment of a permanent secretariat. It recommended to the NAS Foreign Secretary that the United States accept the highest dues category as established by the General Assembly.

The X International Nutrition Congress and General Assembly of the IUNS was held in Kyoto, Japan, in August 1975. The Committee noted that the United Nations University, now established in Tokyo, had cited world hunger alleviation as one of its primary programs. Mutually beneficial relationships between the University and IUNS are regarded as essential.

U.S. NATIONAL COMMITTEE FOR PHOTOBIOLOGY (USNC/PHOTOBIOLOGY)

The Committee reviewed the program for the forthcoming VII International Photobiology Congress and established a deadline for travel grant applications to the Congress. A subcommittee was nominated to screen the applications. Dr. James W. Longworth was nominated as the official delegate of the National Academy of Sciences.

Dr. Harold F. Blum, Professor of Biology, State University of New York at Albany, and Dr. Cornelis B. Van Niel (emeritus), Stanford University, were nominated for the Niels Finsen Prize, awarded at each General Assembly of CIP. These nominations were forwarded to the Secretary General, CIP.

Dr. Thomas B. Fitzpatrick, Massachusetts General Hospital, discussed the use of psoralens, a group of photoactive compounds, in photochemotherapy. These compounds are demonstrably effective against psoriasis and in treatment of vitiligo (absence of skin pigmentations). A five-year program of controlled tests is now under way in this country in cooperation with European hospitals.

The Committee advised the Chairman of the Climatic Impact Committee on the need for greater attention to long-range research on the effects on biological communities of changes in the ozone layer attributable to supersonic transport emissions. The Committee also reviewed the NRC report, *Phototherapy in the Newborn,* and agreed that the clinical recommendations in the report need broad dissemination. The Academy of Family Physicians and the Academy of Pediatrics were asked to give wide circulation to these recommendations. The Committee informed the Director of the National Institute of Child Health and Human Development of its firm support for research on biological effects of light on man.

INSTITUTE OF LABORATORY ANIMAL RESOURCES (ILAR)

ILAR is a coordinating agency that disseminates information, surveys existing and required laboratory animal resources, develops guidelines, promotes education, holds conferences, and generally works to upgrade laboratory animal resources within the United States and abroad. Since it was established in 1952, the Institute has become a focal point for information on laboratory animals and a key advisory group in laboratory animal science.

In September 1975, ILAR, the Armed Forces Institute of Pathology, and the National Oceanic and Atmospheric Administration sponsored a three-day workshop on Nomenclature of Molluscan Pathology. Certain molluscs, such as the common eastern oyster (*Crassostrea virginica*) and the blue mussel (*Mytilus edulis*), have been studied in a variety of ways, but to date the nomenclature and classification of various inflammatory, regenerative, hyperplastic and neoplastic lesions are uncertain. Because molluscs are increasingly recognized as valuable indicators of estuarine and marine pollution levels, it is advisable to develop a uniform terminology.

Committee on Conservation of Nonhuman Primates

This Committee was organized in 1970, in response to a request from the National Institutes of Health and the Department of Defense, to examine the distribution and abundance of the most commonly used species of nonhuman primates and to assess the effect of ecological changes and harvesting on wild populations. The Committee recently completed field studies of selected South American primates in Colombia, Peru, Guyana, and Bolivia through a subcontract with the Pan American Health Organization. A report of the field surveys in Guyana and Bolivia was published in April 1976.

Committee on Animal Models and Genetic Stocks

The Committee collects, maintains, and disseminates information on animal models and genetic stocks useful in biomedical research. Data are made available to scientists through the *ILAR News* and by direct response to specific inquiries.

Committee on Histologic Classification of Laboratory Animal Tumors

The Committee is charged with developing and promoting worldwide standardization of tumor classification in laboratory animals comparable to that now available relative to human neoplasms.

Committee on Care and Use of Spontaneously Hypertensive Rats

The spontaneously hypertensive rat (SHR) was developed about ten years ago through selection for elevated blood pressure. The strain is now one of the more widely studied animal models of hypertension. The Committee, formed in 1974, has assessed the appropriateness of the SHR as a model of human essential hypertension, developed guidelines for its breeding, care, and use, and provided information on normotensive control animals.

Committee on Standards for Cats

The guidelines being developed by the Committee represent a comprehensive effort to examine the biology of the cat and maintenance of cats under laboratory conditions from the time they are procured until the investigation is completed. The Committee's report is nearing completion.

Committee on Standards for Birds

The Committee is developing guidelines on the breeding, care, and management of wild birds under laboratory conditions.

Committee on Care and Use of Laboratory Animals

The Committee reviewed the 1972 *Guide for the Care and Use of Laboratory Animals* and recommended that it be revised during fiscal year 1977.

Committee on Laboratory Animal Housing

The Committee is planning a symposium, scheduled for September 22–23, 1976, emphasizing modern design and construction criteria for laboratory animal housing. Items to be discussed include: criteria for animal room design, construction materials, programming for isolation, quarantine, and infectious disease facilities, waste disposal, including incinerating systems, caging, and cage washing areas.

Committee on Care and Use of Rodents

The Committee is revising the 1969 publication, *Standards for the Breeding, Care, and Management of Laboratory Animals—Rodents.*

Committee on Genetic Standards

The Committee is revising the 1969 publication, *A Guide to Genetic Standards for Laboratory Animals.*

Committee on Animal Models for Thrombosis and Hemorrhagic Diseases

This Committee was established in 1974, in response to a request from the National Heart and Lung Institute of the National Institutes of Health, to organize and conduct an in-depth workshop on thrombosis and hemorrhagic diseases. The workshop was held in March 1975; the proceedings will be published by the Government Printing Office from camera-ready copy prepared by ILAR.

Committee on Care and Use of the "Nude" Mouse

The Committee has developed guidelines for the care and use of the "nude" mouse. The mouse mutant is gaining importance as an animal resource for medical research, particularly in the areas of immunology and oncology. The guidelines recommend procedures for the care, production, and transportation of nude mice and appraise the present knowledge and accepted practices developed from experience with large colonies.

Committee on Long-Term Holding of Laboratory Rodents

The Committee has developed guidelines for the long-term care and maintenance of laboratory rodents (e.g., mice, rats, and hamsters).

Organizing Committee for the Symposium on the Future of Animals, Cells, Models, and Systems

In October 1975, the Committee held a two-day symposium on the Future of Animals, Cells, Models, and Systems in Research, Development, Education, and Testing. Through this symposium, ILAR examined the contributions of animals to human health and welfare; the use and limitations of cell, tissue, and organ cultures; and the application of statistical and computer technology as a substitute for laboratory animals in biomedical research. Proceedings will be published in late summer 1976.

FOOD AND NUTRITION BOARD

Most of the Board's studies are conducted by its several committees, whose work is reviewed by the Board and its Executive Committee.

Committee on Clinical Nutrition

The Committee was established to prepare a handbook for the practicing physician for use in the diagnosis and treatment of clinical conditions either caused by nutritional problems or in which malnutrition plays a contributing or secondary role. Seventy-five percent of the handbook has been drafted. It will contain an introduction, giving examples of therapeutic failures caused by failure to recognize nutritional factors; and chapters on: indications for taking a nutritional history and essentials of nutritional history; essentials of the physical examination; laboratory tests for nutrient levels or status; and principles of management. These will be followed by brief monographs on diet in relation to various clinical problems.

Committee on Dietary Allowances

The Committee is working on the ninth edition of *Recommended Dietary Allowances;* publication is expected in 1978 or 1979.

Committee on Food Protection

In its concern for food safety, the Committee has conducted studies on food microbiology, nonnutritive sweeteners, toxicology, food technology, naturally occurring toxicants in foods, radionuclides in foods, specifications of identity and purity of food chemicals, and carcinogenic hazards. Specific tasks are assigned to subcommittees established for that purpose.

Subcommittee on Food Microbiology

The Subcommittee's report, *Prevention of Microbial and Parasitic Hazards Associated with Processed Foods: A Guide for the Food Processor,* was published during the year. The report is intended especially for the small food processing organization that has no trained microbiologist on its staff.

Subcommittee on Food Technology

The report, *Technology of Fortification of Foods* (see page 22), was published during the year. The Food and Drug Administration has stated that it will evaluate the safety of foods that have been modified by processing techniques introduced commercially since January 1, 1958. The Subcommittee has prepared a proposal to review the nutritional value, microbiological safety, and chemical safety of two selected processed: high-temperature/short-time processing and alkali treatment of proteins.

Subcommittee on Toxicology

The Subcommittee proposes to review and assess the Food and Agriculture Organization, World Health Organization "tolerable weekly intakes" for mercury, lead, and cadmium, and will evaluate the applicability and relevance of these guidelines for various sectors of the U.S. population.

Subcommittee on Codex Specifications

The proceedings of a March 1975 symposium on Specifications for Food Chemicals were published in October 1975. The *Food Chemicals Codex* (FCC) is a compendium of quality and purity standards for food additives and is revised periodically. Preparations are under way for the third edition of the *Codex,* which is due in fiscal year 1978.

Committee on Food Science and Technology

This Committee was formed in 1974 to assess—in the face of clear trends in national food production, handling, and processing—the existing scientific and technical manpower resources and the manpower and research needs for the next decade. The Committee has prepared a preliminary draft of that portion of its report dealing with research needs.

Committee on GRAS List Survey—Phase III

This study began in 1974 in response to a Food and Drug Administration (FDA) request stemming from a directive in President Nixon's consumer message concerning the need to reevaluate the safety of substances added to foods that are generally recognized as safe (GRAS). The objectives of Phase III of the study are to determine the levels at which individual food additives (as opposed to the GRAS substances) are added to foods, the foods to which they are added, and the expected daily intake of each additive. Based upon a pilot survey of food processors and food additive manufacturers, as well as upon discussions at two workshops during the year, the Committee has prepared survey materials that will be mailed to more than 600 food processors and food additive manufacturers, who will be asked to report on the 725 additives that fall within the scope of the survey.

Committee on International Nutrition Programs

Since 1970, the Committee has provided advice on overseas problems and activities in nutrition to the Office of Nutrition, Agency for International Development. During the past year, the Committee prepared reports on *Priorities for Research on Iron Deficiency* and *Priorities for Research on Avitaminosis A and Xerophthalmia.* Ten other reports are in preparation.

Subcommittee on Interactions of Nutrition and Infection

The Subcommittee is preparing for publication the proceedings of a workshop on Immune Response of the Malnourished Child. In May 1976, the Subcommittee sponsored a workshop on the Impact of Infection on the Nutritional Status of the Host

Subcommittee on Nutrition and Fertility

The Subcommittee has developed plans for a workshop on the Biological Aspects of the Relationship of Nutrition to Human Fertility.

Committee on Nutrition, Brain Development, and Behavior

The Committee organized a meeting in Cali, Colombia, of leading scientists in six current Western Hemisphere field studies. The purpose was to foster, wherever feasible, cooperation in further development of the programs. The studies represented at the meeting were: one in New York City, two in Mexico, two in Colombia, and one in Guatemala.

Committee on Dental Health

This Committee plans to review the general question of nutrition and dental health, with special reference to: the role of foods and individual nutrients in tooth development; the role of foods, individual nutrients, and eating habits in dental caries; and the local and generalized effect of foods and nutrients on periodontal health

Committee on Nutritional Misinformation

This Committee was formed to prepare, for distribution to the press and other media, brief statements refuting widely held misconceptions about nutrition—particularly those that are potentially hazardous to health. A statement dealing with lecithin in human nutrition has been drafted. Statements are planned on soil fertility in relation to nutrient content of foods and on weight-control diets.

Committee on Nutrition of the Mother and Preschool Child

A statement on "Oral Contraceptives and Nutrition" was prepared and submitted to the Bureau of Community Health Services for distribution to health clinics throughout the country. A short report, *Iron Nutriture in Adolescence,* is being reviewed.

The Committee is preparing a major work, *Biochemical Indices of Nutritional Status in Normal Pregnancy.* The report is intended primarily to assist physicians in accurate evaluation of biochemical measurements in pregnant women that are normal for pregnancy but different from those of nonpregnant women. The report will cover: a review of physiological adjustments in a healthy pregnancy, hematological adaptations, serum electrolytes, carbohydrate and lipid indices, nitrogenous compounds, vitamin indices, and trace elements.

Committee on Sodium-Restricted Diets

The Committee was organized in 1972 to update and review the 1954 NAS Publication No. 325, *Sodium-Restricted Diets.* The report will include basic information on physiological disposition of sodium, conditions in which sodium restriction and/or diuretics are used therapeutically, and practical aspects of planning sodium-restricted diets with or without concomitant diuretic therapy. It will also contain current information on the sodium content of processed foods, based primarily on information provided through the Industry Liaison Panel of the Food and Nutrition Board. It is anticipated that the report will be completed early in fiscal year 1977.

Division of Medical Sciences

COMMITTEE ON THE BIOLOGICAL EFFECTS OF IONIZING RADIATIONS (BEIR)

In the spring of 1973, the Environmental Protection Agency asked the BEIR Committee to develop quantitative benefit-assessment techniques that could be used in comparative benefit-cost analysis of activities involving exposure to ionizing radiation from X-rays, other medical uses, and from nuclear power generation. Subsequently, the Committee will develop similar techniques for various categories of radiation exposure, such as occupation-related exposure.

Subcommittees on Concepts, Medical Usage of Ionizing Radiations, Nuclear Energy (Power), and on Other Uses of Ionizing Radiations have drafted chapters that will be included in the Committee's report. The report will contain chapters on Historical Background and Needs of the Times, as well as a summary and conclusions.

BEIR COMMITTEE ON INHALED OR INGESTED "HOT PARTICLES"

This ad hoc Committee was established under the general supervision of the BEIR Committee to examine, for the Environmental Protection Agency, the existing standards for plutonium emissions, with particular emphasis on reevaluating the biological effects of plutonium (hot particles) on man. The Committee's final report, *Health Effects of Alpha-Emitting Particles in the Respiratory Tract,* was completed in May 1976. The Committee found no evidence to indicate a need for changing existing radiation protection guidelines.

COMMITTEE ON BIOMEDICAL RESEARCH IN THE VETERANS ADMINISTRATION

This Committee was formed in 1974 at the request of the Administrator of the Veterans Administration (VA). It was asked to assess the VA's biomedical research effort, including relevant aspects of the training program, with respect to quality and to the manner and extent of its contribution to patient care. The Committee expects to complete its report in the fall of 1976. The Committee's evaluation is based on data collection, interviews, site visits to a random sample of VA hospitals, a bibliographic study in which the quality of all VA scientific articles published over a two-year period was assessed, and a study of clinical aspects of the patient in VA research.

COMMITTEE ON BIOSPHERE EFFECTS OF EXTREMELY LOW FREQUENCY RADIATION

The U.S. Navy has proposed a communication system (Project Seafarer) designed to provide almost worldwide contact with submerged submarines, operating deep and fast, from a single transmitting location in the United States under conditions of maximum survivability and resistance to electromagnetic interference. The extensive antenna system and the high level of electric energy required for signal transmission has raised questions concerning possible biological effects in the immediate environment. The Navy, therefore, asked the National Academy of Sciences to "review the status of our knowledge" pertaining to the biological and ecological effects of extremely low frequency (ELF) radiation characterized by the Project Seafarer system. The Committee on Biosphere Effects of Extremely Low Frequency Radiation was formed in response to this request.

COMMITTEE ON BRAIN SCIENCES

This Committee was established at the request of the National Institute of Mental Health to evaluate the impact of research on discoveries in mental health and neurology. Four models were chosen for analysis: the use of certain drugs in mental disease states, the diagnosis and treatment of convulsive disorders, behavior modification, and the importance of early experience in child development. The first two models have been completed. The goal of each study is to analyze, and document through case histories, the role of research *vis à vis* other factors that facilitate its application.

COMMITTEE ON CLINICAL EVALUATION OF NARCOTIC ANTAGONISTS

In 1971 the Special Action Office for Drug Abuse Prevention was established in the White House Executive Office pending the establishment of a National Institute on Drug Abuse (NIDA) in the National Institutes of Health. In 1973, the Special Action Office concluded that there was evidence that chemical compounds (antagonists) that blocked the euphoric effects of narcotics showed promise when administered on a daily basis. The Academy was asked to arrange controlled pilot studies to acquire more information on the efficacy and toxicity of the antagonists in man, to test the feasibility of such studies, and to perfect protocols for subsequent large-scale studies. The Committee on Clinical Evaluation of Narcotic Antagonists drafted protocols, developed data collection techniques, selected naltrexone as the antagonist to be studied, and assisted in the selection of the five clinics to be involved. The clinical investigations are carried out under grant or contract to the NIDA. The Committee is charged only with monitoring data and adherence to protocol, and, ultimately, with the analysis of the data. A final report will be sent to the sponsor in the fall of 1976.

COMMITTEE ON PROBLEMS OF DRUG DEPENDENCE

Over the years, the Committee operated a grants program in the areas of drug dependence and abuse, with emphasis on narcotic analgesics, and conducted a drug dependence research (screening) program for testing new compounds for drug dependence potential. Some 50 papers on new developments in drug abuse are presented at the Committee's annual meetings. The Committee's 38th annual scientific meeting was held in June 1976. The proceedings will be published in the fall of 1976. The Committee was disbanded on June 30, 1976.

DRUG RESEARCH BOARD

The Board sponsored a workshop on Clinical Trials of Drugs in March 1975 at the Medical University of South Carolina. The objectives were to identify and rank, in order of estimated importance, the problems involved in improving the quality of clinical trials of drugs. The proceedings were published as a supplement to the journal, *Clinical Pharmacology and Therapeutics,* in November 1975. The second workshop on Dermatopharmacology was held at Bryce Mountain, Virginia, in August 1975. It centered on metabolic regulation and pharmacological modulation of inflammation. The proceedings will be published in the *Journal of Investigative Dermatology* in the fall of 1976. The Board was disbanded on June 30, 1976.

COMMITTEE ON EMERGENCY MEDICAL SERVICES

The report of the task force on classification and training of emergency medical technicians was submitted to the Department of Health, Education, and Welfare in December 1975. The Committee also reviewed the American National Red Cross' handbook, *Health in the Home.* In June 1976, the Committee held a conference on airway maintenance, including discussions of techniques and devices used by laymen, paramedics, and physicians. The conference was supported by the National Heart and Lung Institute, the American National Red Cross, and the American Heart Institute.

COMMITTEE ON HANDICAPPING ORTHODONTIC CONDITIONS

This Committee was established in 1974 in response to a request from the Office of the Surgeon General, U.S. Army. It was asked to make recommendations, for use in military health care programs, on a definition of orthodontic conditions that are designated to be seriously handicapping, and on objective criteria that will define and characterize such handicapping conditions.

The Committee's report was published in May 1976. Recommendations are provided not only for the identification of seriously handicapping orthodontic conditions, but also for the implementation of a program for identifying people with such conditions.

COMMITTEE ON RESEARCH NEEDS ON THE HEALTH EFFECTS OF FOSSIL FUEL COMBUSTION PRODUCTS

The Committee is charged with: (1) Identifying pollutants, potentially toxic to man, that are released into the environment during the combustion of fossil fuels and that may have potential long-term genetic and somatic effects; (2) determining what research is needed to establish the health effects of those pollutants (including the influence of interaction between pollutants, meteorological, or climatological factors, and the particular susceptibility of certain elements of the population and certain organ systems, such as heart, lungs, skin, and urinary system), and the effects of concentration and pass-through of aerosol, particulate, and thermal loads on biologic systems; (3) reviewing and assessing existing data from the standpoint of the validity of the methodology, analytic techniques, and interpretation of the investigations concerned; identifying areas in which the desired information is inadequate or absent; and recommending a program of research designed to acquire the necessary information, including a system of priorities, and, where feasible, preferred methodology. The Committee will not address itself to regulatory decisions concerning exposures.

COMMITTEE TO REVIEW THE USE OF IONIZING RADIATION FOR THE TREATMENT OF BENIGN DISEASES

The Committee has developed a list of some 125 benign diseases that have been or are being treated by ionizing radiation. It has also begun to develop information on the incidence of such treatment as well as by whom such treatment is given (e.g., radiology departments, dermatologists, ophthalmologists, etc.) The various physical and biological parameters of treatment are also being assessed as a basis for determining whether or not the radiation used in the treatment modalities presents a problem of future risk to individuals treated.

COMMITTEE ON TEACHING/RESEARCH MANPOWER NEEDS IN BASIC NEUROLOGIC AND COMMUNICATIVE SCIENCES

The Committee was established in 1973 to review and evaluate the present and future status of teaching and research manpower in the basic neurologic and communicative sciences, and to recommend a program for meeting teaching and research manpower needs in 1985. The study includes an estimation of the present requirements for and the utilization of neurologic and communicative scientists and their demographic and scientific characteristics. The study was completed in June 1976 and the report will be published in the fall.

BOARD ON MATERNAL, CHILD, AND FAMILY HEALTH RESEARCH

The Board, which was organized in 1974, has the following functions: (1) To identify the health needs of young persons (infants, children, and adolescents), viewing them as the potential parents of unborn generations. (2) To extract material on a continuing basis from research reports and national health statistics in order to help identify maternal, child, and family health needs, and to suggest priorities for improving maternal, child, and family health. (3) To maintain broad surveillance of the private and public policies and practices that influence the course of maternal, child, and family health care and research and to provide a forum for discussion and study of change. (4) To help direct public and private resources toward a coherent national effort on behalf of maternal, child, and family health. Committees are established under the Board for the conduct of specific studies.

Committee for a Study for Evaluation of Testing for Cystic Fibrosis

The Committee transmitted its report to the National Institute of Arthritis, Metabolism, and Digestive Diseases and the Division of Lung Diseases of the National Heart and Lung Institute in October 1975. The report reviews, analyzes, and makes recommendations on three primary areas related to testing for cystic fibrosis: the clinical aspects, research in cystic fibrosis, and testing for cystic fibrosis, including instrumentation for the performance of the sweat test, prenatal diagnosis, and the setting in which testing is currently performed. The report was published as a Supplement to the *Journal of Pediatrics* in April 1976.

Committee on Implications of Declining Pediatric Hospitalization Rates

The Committee was established in July 1975, under the sponsorship of the Bureau of Community Health Services, DHEW, to review present data on pediatric bed occupancy rates and outpatient visits and to recommend ways to improve the collection of this type of information. The Committee will also suggest ways of using this information to plan an adequate distribution of available clinical resources for both inpatient and outpatient care.

Committee for the Study of Inborn Errors of Metabolism

More than 3,000 copies of the Committee's report, *Genetic Screening: Programs, Principles, and Research,* have been distributed to medical school libraries, schools of public health, and others since its publication in April 1975. The procedural section of the report and its recommendations were subsequently published in pamphlet form to serve as a guide for persons actively involved with genetic screening. A third publication, *Genetic Screening: A study of the Knowledge and Attitudes of Physicians,* was published in August 1975. The Committee will be disbanded by December 31, 1976.

Committee on Maternal and Child Health Research

In February 1975, this Committee was established to review research and training programs throughout the Department of Health, Education, and Welfare that have as their objectives the improvement of the health of mothers and children. The Committee concentrated on Public Health Service programs for the last five years, examining 1973 in the greatest statistical depth. The *Report of the Committee on Maternal and Child Health*

Research was transmitted to its sponsor, the National Institute of Child Health and Human Development in May 1976. It is expected to be helpful to the federal agencies that support research in maternal and child health and to Congress, as well as to basic and clinical researchers.

COMMTTEE ON MEDICAL AND BIOLOGICAL EFFECTS OF ENVIRONMENTAL POLLUTANTS

The Committee evaluates the current state of knowledge, based on the latest scientific data, of the medical and biologic effects on plants, animals, and humans of various pollutants in the environment. Nine reports have been submitted to the Environmental Protection Agency and have been published by the National Academy of Sciences to make them available to the scoentific community. The subject of these reports are: asbestos, fluorides, lead, particulate polycyclic organic matter, manganese, chromium, vanadium, nickel, and vapor-phase organic pollutants. The Committee has also sent to EPA three reports—scheduled for publication in fiscal year 1977—on selenium, chlorine and hydrogen chloride, and ozone and other photochemical oxidants. These reports provide information that the EPA may need to make decisions regarding regulatory actions or legislative recommendations. Work is continuing on reports dealing with airborne particles, ammonia, arsenic, carbon monoxide, copper, hydrogen sulfide, iron, nitrogen oxides, platinum-group metals, and zinc.

MEDICAL FOLLOW-UP AGENCY

COMMITTEE ON EPIDEMIOLOGY AND VETERANS FOLLOW-UP STUDIES

This program, originated in 1946, facilitates the use of federal records—chiefly, the medical records of the Armed Services and of the Veterans Administration—for medical research. The Medical Follow-Up Agency acts as a resource for records and statistics, helping qualified investigators to obtain information from the records and participating in the analysis of data. It is supported by contracts with the Veterans Administration, the National Institutes of Health, National Cancer Institute, National Heart and Lung Institute, and the Bureau of Radiological Health, and, occasionally, by subcontracts with universities. The Committee on Epidemiology and Veterans Follow-Up Studies provides policy guidance.

Studies under way include: Influence of POW Experience on Subsequent Mortality; Natural History of Multiple Sclerosis; Clinical Trials of Cancer Therapy; Epidemiology, Course, and Prognosis of Amyotrophic Lateral Sclerosis; Medical Genetic Studies of Twins; Early Predictors of Cardiovascular Disease; Late Mortality and Morbidity Effects of Occupational Exposure to Microwave Radiation (RADAR); Identification of

Groups Marked by High Risk of Cancer; Sarcoidosis and Mortality from Cancer; Microwave Cataract Screening; Cancer Mortality Among Army World War II X-ray Technicians; Epidemiology of Hodgkin's Disease; Childhood Cancer and Prenatal X-ray; Monitoring Records Resources; and Preservation of Diagnostic Index to Navy Medical Experience of World War II.

COMMITTEE ON MILITARY ENVIRONMENTAL RESEARCH

A task force, composed of Committee members supplemented by other experts, was organized to assist in land renovation studies. The Army has approximately 50 military reservations that, in the past, have been contaminated by munitions and chemical, biological, and radiological agents. Before these reservations can be renovated, standards must be established that will protect humans, animals (domestic and wild), vegetation, and aquatic life from adverse effects of these contaminants. The task force made recommendations to the Committee concerning protocols for research to determine the toxicity of the contaminants that are present.

In addition, the Committee has been asked to consult on the development of equipment to be used in connection with a water reuse (nonconsumptive use) system being developed for the Medical Unit Self-Contained Transportable (MUST) hospital. The Committee continues to be consulted about research related to the safety of land disposal of waste water, as well as the development of standards for munitions waste (liquids and air).

COMMITTEE ON NATIONAL NEEDS FOR THE REHABILITATION OF THE PHYSICALLY HANDICAPPED

The Committee was organized in 1975 to explore the opportunities offered by recent scientific research and technologic capabilities for restoring physically handicapped people to an active role in society. From information gathered at a workshop in the summer of 1975, the Committee has drafted its report. The Committee expects to complete its work in the fall of 1976.

COMMITTEE ON PUBLIC INFORMATION IN THE PREVENTION OF OCCUPATIONAL CANCER

The National Cancer Institute (NCI) is charged with developing a national Cancer Control Program. As part of that program, the Labor Department's Occupational Safety and Health Administration (OSHA) has agreed to develop, jointly with the NCI and the National Institute of Occupational Safety and Health, an Occupational Cancer Information and Alert Program. The Committee is charged with providing to OSHA broad guidelines for the Program. In February, the Committee held a public meeting to hear issues identified and opinions expressed. The Committee has met with representatives of labor groups and management, and will conduct a symposium in December. A report will be made to OSHA when the project is completed.

COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT/PROSTHETIC-ORTHOTIC EDUCATION

The Committee on Prosthetics Research and Development (CPRD) serves research in the fields of prosthetics, orthotics, and sensory aids in order to advance knowledge and raise the level of practice. The Committee on Prosthetic-Orthotic Education (CPOE) assists in the dissemination of information to administrators, physicians, paramedical personnel, and other practitioners working in prosthetics, orthotics, and sensory aids, and promotes the use of scientific and technical knowledge in these areas.

Reports of three clinical evaluations were completed during the year: (1) The evaluation of the Rancho Los Amigos Hospital/Medtronic, Inc., implanted neuromuscular assist device. (2) The evalution of the Ortho-Walk Type B Pneumatic Orthosis. (3) The evaluation of the "Boston" Prefabricated Girdle for the Milwaukee (CTLS) Orthosis. Other publications include: volume two of the *Prosthetics and Orthotics Research Reference Catalogue;* two issues of the *Newsletter. . . Amputee Clinics;* the *1975 Roster of Amputee Clinics in the United States and Canada;* and several technical reports.

COMMITTEE ON THE RADIATION REGISTRY OF PHYSICIANS

The Committee advises the Radiation Registry of Physicians of the Bureau of Radiological Health, Food and Drug Administration, on a study of the somatic and genetic effects of occupational exposure of physicians to X-rays.

COMMITTEE ON REGIONAL EMERGENCY MEDICAL COMMUNICATIONS SYSTEMS

The Committee was organized in August 1973 to conduct for the Robert Wood Johnson Foundation a national competitive program for the funding of regional emergency medical communications systems. The Committee reviewed 256 applications through a succession of screening processes, culminating in about 60 site visits by Committee members, consultants, and staff throughout the United States and Puerto Rico. The Committee has the further task, during the three postfunding years, of reviewing the progress of the grantee organizations and reporting to the Foundation on the impact of the program. An interim report was sent to the Foundation in July 1975.

TOXICOLOGY INFORMATION PROGRAM COMMITTEE

The Toxicology Information Program (TIP) was established in the National Liberty of Medicine in 1966 as a result of a recommendation of the President's Science Advisory Committee to develop a computer-based file of toxicology information that wouldd become widely available. The Committee was formed in 1968 in response to a request for assistance from the Director of the National Library of Medicine. The Assembly of Life Sciences has also been asked to make the Committee's services available to the Toxicology Information Subcommittee of the Department of Health, Education, and Welfare Committee to Coordinate Toxicology and Related Programs.

COMMITTEE ON VETERINARY MEDICAL SCIENCES

The Committee is concerned with the welfare of veterinary medicine, with maximizing the participation of veterinary medical scientists in biomedical research and education, and with making the resources of the veterinary medical community available to the biomedical research endeavor. The Committee has drafted a proposal for a study dealing with the "Role of the Veterinary Medical Sciences in Biomedical Research and Education."

COMMITTEE ON VIRAL HEPATITIS

The Committee was established in 1971 at the request of the National Institutes of Health to develop a system for facilitating communication among investigators, to coordinate the research activities of public and private organizations, to make recommendations for new research, and to promote the application of the results of research to the control of viral hepatitis. During fiscal year 1976, the Committee joined with the U.S. Public Health Service Advisory Committee on Immunization Practices in further updating and expanding its "carrier" statement. This revision, entitled "Perspectives on the Control of Viral Hepatitis, Type B," was published and the Committee was disbanded on June 30, 1976.

U.S.A. NATIONAL COMMITTEE FOR THE INTERNATIONAL BRAIN RESEARCH ORGANIZATION (USANC/IBRO)

In May 1972, the National Academy of Sciences, at the invitation of the Secretary General of IBRO, became the adhering body for the United States and established the U.S.A. National Committee to effect appropriate U.S. participation in IBRO and to advise the Academy on international matters relevant to neuroscience. The Committee has recommended that steps be taken to hold regular IBRO symposia in conjunction with Society for Neuroscience meetings, bringing together scientists from various parts of the world with whom U.S. scientists can exchange materials, techniques, and knowledge. The Committee also began preparations to work with the Society for Neurosciences, the International Primatology Society, and the ALS Committee on Primates (Institute of Laboratory Animal Resources) to develop a white paper that will consider whether subhuman primates are being exploited unnecessarily.

U.S.A. NATIONAL COMMITTEE ON THE INTERNATIONAL COUNCIL OF SOCIETIES OF PATHOLOGY (USANC/ICSP)

In 1957, in an effort to promote worldwide standardization of tumor classifications in the furtherance of medical treatment and research, the World Health Organization (WHO) established 27 International Reference Centers (IRC's) to handle the operational aspects of classifying the tumor types selected for study. The International Council of Societies of Pathology was subsequently established to advise the Cancer Unit of WHO concerning the program. Since 1962, the National Academy of Sciences has maintained the U.S.A. National Committee to coordinate the policies and activities of the five participating societies of pathology in the United States: The American Association of Pathologists and Bacteriologists, the American Society of Clinical Pathologists, the American Society for Experimental Pathology, the College of American Pathologists, and the U.S.-Canadian Division of the International Academy of Pathology. To date, 13 IRC's have completed their work, published manuals, and prepared transparencies for distribution.

The U.S.A. National Committee sends a promotional and educational exhibit, constructed and maintained by the Armed Forces Institute of Pathology, to national and regional meetings of pathology societies, and arranges for lectures during the meetings of pathologists. A questionnaire has been prepared on the use of the IRC materials that will be sent to approximately 350 directors of approved residency training programs in pathology.

U.S.A. NATIONAL COMMITTEE ON THE INTERNATIONAL UNION AGAINST CANCER (USANC/UICC)

This Committee seeks support for U.S. participation in the UICC, nominates and briefs representatives to meetings of the UICC, provides for the administration of the payment of the national subscription to the UICC on behalf of the United States, maintains an office or facilities for the transmission of information relating to cancer, encourages U.S. membership in the UICC and reviews and comments on membership applications, and recommends to the Nominating Committee of the UICC candidates for all offices. During the past year, the Committee was authorized to conduct a travel grant program for U.S. participants in the XII International Cancer Congress in Buenos Aires in October 1978.

U.S.A. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF PHYSIOLOGICAL SCIENCES (USANC/IUPS)

The Committee will conduct a travel grant program for the XXVII IUPS Congress in Paris in July 1977. The Committee is also cooperating with the National Organizing Committee in Paris on the scientific program of the Congress. The Committee proposed IUPS cooperation in the generation of a world list of physiologists to be maintained by the American Physiological Society. In view of the creation over the past ten years of a number of new, specialized societies of interest to physiologists, the Committee discussed the question of broadening its representation to improve communication with a greater number of physiologists.

ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES

This Assembly is concerned with astronomy and astrophysics, chemistry and chemical technology, earth sciences, mathematical sciences, physics, and space sciences. Its major objectives are (a) to maintain awareness of the health of the disciplines; (b) to identify problems and opportunities in them and to initiate timely studies addressed to these needs; and (c) to assist the National Research Council in fulfilling its responsibilities.

Among the activities completed during the past fiscal year were the ACDA [Arms Control and Disarmament Agency] Workshop, which produced the report, *Long-Term Worldwide Effects of Multiple Nuclear Weapons Detonations* (see page 40); the ten-year series of studies for the U.S. Coast Guard by the Committee on Hazardous Materials; the U.S. National Committee for the International Hydrological Decade, which guided U.S. participation in this worldwide research and data-collection program; and the Solar Energy Research Institute Study Committee, which dealt with the proposed Institute's mission, facilities and criteria for site selection, staffing, organizational structure and management, and relationships to industrial, academic, and other govenmental organizations.

The following Assembly boards and committees began or continued their activities and studies in fiscal 1976.

AIR FORCE STUDIES BOARD

(Transferred to the Assembly of Engineering, April 24, 1976)

The Board provides guidance to the Air Force Systems Command on scientific and technical questions related to the mission of the Command, such as orbital determinations, flight dynamics, electronics, materials and structures, and air and space vehicles. Two panel reports were issued during the year: *Reliability in Aeronautical Avionics Equipment* and *Transonic Axial-flow Compression Configurations for Aircraft Propulsion Systems—*

Background and Current Status. Currently, plans are in progress for a summer study on computer software management and development in relation to Air Force programs.

COMMITTEE ON ANALYTICAL CHEMISTRY

The objective of this Committee is to foster cooperative activities between analytical chemistry and other fields of science. It has been concerned with the training of analytical chemists and the quality of measurements in fields related to national health.

COMMITTEE ON APPLICATIONS OF MATHEMATICS

In response to a request from the Mathematical and Information Sciences Division, Office of Naval Research, this Committee established, in January 1976, a new panel composed of theoretical and applied mathematicians, computer specialists, statisticians, and others to identify opportunities and needs for mathematical research and applications in Naval Research programs. The Committee has also been assisting in the planning of a new Assembly Committee on Applied Mathematics Training that will study curriculum needs in applied mathematics, problems in the acceptance and implementation of new curricula, and ways to assist mathematics faculties in the presentation of new courses. Currently, the Committee is exploring the feasibility of a program of fellowships in applied mathematics, which would be undertaken in cooperation with the Commission on Human Resources.

COMMITTEE ON ATMOSPHERIC SCIENCES

The Committee reviews research and development, education and manpower, and related matters affecting the progress of the atmospheric sciences. Through special studies conducted by *ad hoc* panels, the Committee encourages the maintenance of a balanced national program in atmospheric sciences research and stimulates U.S. participation in international research programs.

The Panel on Atmospheric Chemistry completed its work with the publication, in July 1975, of its report outlining programs and policies needed to extend understanding of atmospheric chemical and photochemical processes. The Panels on Short-Range Prediction and Severe Storms have studied detection, monitoring, and warning procedures for small-scale, short-term weather dangers and potential disasters and will publish their joint report in fall 1976. In response to a request from the National Oceanic and Atmospheric Administration, a panel was established to provide scientific guidance on Project STORMFURY (the modification of winds and storm surges in hurricanes). In addition, in response to requests from the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration, the Committee has established a number of panels to review these agencies' atmospheric research and development activities. The Committee is also preparing a report on "The Atmospheric Sciences: Problems and Applications."

COMMITTEE ON ATOMIC AND MOLECULAR SCIENCE

Two *ad hoc* panels of this Committee completed studies this past year, with reports currently in press. The Panel on Accelerator-Related Atomic Physics Research reported the results of a survey of the types of facilities used for atomic and molecular research, the amount of beam time devoted to such research, sources of support, and specific fields being investigated. The Subcommittee on Energy-Related Atomic and Molecular Science directed its attention to present and potential contributions of atomic and molecular research to the development of various energy technologies. The Subcommittee is now planning a series of small-scale studies to delineate the role of atomic and molecular science in the exploration of problems in controlled thermonuclear reactions, magnetohydrodynamics, gaseous electronics, synthetic fuels, and other energy-related fields.

COMMITTEE ON CHEMICAL CRYSTALLOGRAPHY

(See U.S.A. National Committee on Crystallography, with which this Committee merged in January 1976.)

COMMITTEE ON GEODESY

This Committee, which was organized in January 1976, is exploring applications in geodesy of new technologies such as long-baseline interferometry, lunar ranging, and satellite altimetry. It will also consider the implications of space-borne instrumentation, in particular the space shuttle and space laboratory, for geodetic research. Other concerns include educational opportunities in geodesy, the status of work in plane surveying and mapping, and special needs, such as more accurate horizontal positioning in deep-sea oceanography. The Committee will establish panels to undertake specific studies. It also plans to sponsor a Senior Scientist "Grants in Geodesy" program.

COMMITTEE ON HIGH-TEMPERATURE SCIENCE AND TECHNOLOGY

The Committee fosters research and data compilation in high-temperature phenomena and related aspects of materials sciences and plans and organizes symposia on timely topics in this field. It cooperates with the Commission on High-Temperature and Refractory Materials of the International Union of Pure and Applied Chemistry. A symposium is scheduled for fall 1976 on "High-Temperature Processes of Geothermal Interest," and plans are already under way for a fall 1977 symposium on "High-Temperature Metal Halide Chemistry."

COMMITTEE ON IMPACTS OF STRATOSPHERIC CHANGE

In response to concern about the potential deleterious effects resulting from the use of chlorofluoromethanes (CFM's), the Panel on Atmospheric Chemistry was formed early in 1975 by the Climatic Impact Committee (retitled Committee on Impacts of Stratospheric Change). The Committee and its panel are examining the extent to which CFM's, emissions from the space shuttle, and other anthropogenic halogen compounds could affect the ozone layer of the stratosphere, and the resulting impacts, particularly on human health. A report is expected by late summer 1976.

COMMITTEE ON KINETICS OF CHEMICAL REACTIONS

The Committee assists in the organization of symposia on timely topics, usually held during meetings of the American Chemical Society.

COMMITTEE ON LINE SPECTRA OF THE ELEMENTS

This Committee encourages the collection and publication of data on the analyses of line spectra, monitors current work, identifies research, education, and training needs, and provides for communication and coordination of research among various laboratories and individual spectroscopists. The Committee organized an international spectroscopy symposium, held at the National Bureau of Standards, Gaithersburg, Maryland, in September 1975. Currently it is working with the editor of the *Handbook of Chemistry and Physics* in a two-year program to update and revise those portions concerned with spectroscopic data and to improve the organization and format of the handbook to make it more useful.

COMMITTEE ON MACROMOLECULAR CHEMISTRY

This Committee assists with the organization of symposia, generally held at meetings of the American Chemical Society, and maintains liaison with the Division of Macromolecules of the International Union of Pure and Applied Chemistry.

COMMITTEE ON NATIONAL STATISTICS

Early in 1972, this Committee came into being in response to a recommendation of the President's Commission on Federal Statistics. A varied program of studies is conducted by a subcommittee and several *ad hoc* panels. The Panel for the Evaluation of Crime Surveys was established in February 1974 to examine and evaluate the National Crime Survey—the large new statistical survey being developed by the National Criminal Justice Information and Statistics Service, Law Enforcement Assistance Administration. It completed an assessment of research design and offered recommendations on ways to strengthen and enhance the usefulness of this survey program. The Panel to Review Statistics on Skin Cancer was established in 1974 to evaluate sets of statistics on skin cancer and to estimate the effect on incidence of skin cancer of increased intensities of ultraviolet radiation caused by reduced stratospheric ozone. Its initial findings were published as an appendix to the report, *Environmental Impact of Stratospheric Flight* (NAS, 1975). As new and more comprehensive data on incidence of skin cancer become available, the Panel plans further analyses and refinement of its preliminary models. The Panel on Methodology for Setting HEW Statistical Priorities examined methods used by one of HEW's component agencies—the National Center for Education Statistics—in determining users' needs for statistics, assessing prospective benefits of statistical activities, and establishing priorities among current and proposed statistics-gathering programs. The Panel on Privacy and Confidentiality as Factors in Survey Response is completing a study of the effects that aspects of privacy and confidentiality—and people's perceptions of them—have on the ability of government statistical agencies to collect full and accurate information from individuals and households. Its report will deal with survey design and methodology, particularly in large-scale substantive studies.

The Committee on National Statistics, in cooperation with the Environmental Studies Board (of the Commission on Natural Resources) and the Numerical Data Advisory Board, established a Subcommittee on Environmental Monitoring to assist the U.S. Environmental Protection Agency to increase the effectiveness of environmental monitoring activities as a basis for regulatory decisions. The Subcommittee has in progress two panel studies on ambient monitoring and source monitoring.

New activities being organized by the Committee at the close of this fiscal year include a Panel on Statistical Requirements in Legislation, a panel to assist the National Center for Productivity and Quality of Working Life by reviewing concepts, methodology, and data gaps in the acquisition of productivity statistics, and a Panel on Statistical Aspects of Federal Paperwork to assist the Commission on Federal Paperwork.

COMMITTEE ON NUCLEAR SCIENCE

The main purposes of the Committee are to stimulate research in the various subfields of nuclear science and to foster the application of the knowledge and methodology of this discipline to problems in related fields.

Through *ad hoc* panels established for a specific project and then discharged, it conducts special studies and surveys. One such panel, on Basic Nuclear Data Compilations, appointed in July 1975 at the request of the Energy Research and Development Administration, evaluated from the point of view of the basic nuclear research community a plan for the creation and maintenance of a master file for nuclear structure and charged-particle reaction data at the National Neutron Cross Section Center, Brookhaven National Laboratory. It completed the study and issued its report to the agency in March 1976. A second panel, on the Future of Nuclear Science, held its first meeting in November 1975, and is preparing a report on the most challenging research questions in this field and on the requirements in facilities and instrumentation to realize its potential. A new Panel on Funding and Level of Effort is exploring ways to maintain an up-to-date data base in this field.

The Committee's one standing subcommittee, on radiochemistry, oversees the production of a monograph series, now numbering more than 60 volumes, dealing with radiochemistry of the elements, radiochemical procedures, and applications of radiochemistry, particularly in environmental sciences and medicine. Completion of five new monographs is expected by the end of 1976, and work is beginning on four more.

COMMITTEE ON RADIO FREQUENCIES

The Committee's principal function is to define and coordinate science and engineering research needs for radio frequencies and, working through U.S. and international organizations, to attempt to secure these frequencies. It produces an annual listing of radio observatories and prepares responses to Federal Communications Commission Notices of Inquiry. The Committee is currently preparing for the World Administrative Radio Conference that will take place in 1979. It has standing subcommittees on radio astronomy and space science.

COMMITTEE ON RECOMMENDATIONS FOR U.S. ARMY BASIC SCIENTIFIC RESEARCH

Through its panels on chemistry, engineering, electronics, geosciences, life sciences, mathematics, metallurgy and materials science, and physics, this Committee assists the U.S. Army Research Office by evaluating the scientific merits of unclassified proposals for basic research. In the case of each proposal, the Committee seeks the opinions of several referees who have knowledge of the special field of the proposal. The appraisals of proposals provided by referees are used by Committee members as the basis for preparing the evaluation. The reports from both Committee and referees are provided to the Army Research Office. Since inception of the program in 1961, nearly 7000 proposals have been evaluated.

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COMMITTEE ON SEISMOLOGY

Four problems of concern to this Committee are (a) the operation and support of the U.S. government-sponsored seismograph networks; (b) the collection, storage, and dissemination of new seismographic data; (c) the effect on academic research of changing trends in seismology (growing emphasis on short-term, applied research); and (d) the application of new knowledge and capabilities in seismology to earthquake prediction and control, geothermal, mineral, and fossil-fuel resource discovery, land-use planning, offshore geological exploration, and other problems of national concern. Late in fiscal 1976, the Committee published its report on *Earthquake Prediction and Public Policy* (see page 43); a major report on "Trends and Opportunities in Seismology" is currently in preparation. New projects under consideration are a review of research on earthquake prediction in the United States, including recommendations on long-range goals, priorities, and required funding, and a study of earthquake-related problems associated with power-plant site selection.

COMMITTEE ON SPECIFICATIONS AND CRITERIA FOR BIOCHEMICAL COMPOUNDS

The Committee establishes specifications for selected commercially available products used in biochemical research, with a view to standardizing and improving quality. It is completing a supplement to the 1972 edition of *Specifications and Criteria for Biochemical Compounds.*

Evaluation Panels for the National Bureau of Standards

The 27 Evaluation Panels operate under the guidance of an Executive Committee, which reviews and coordinates their efforts. The panels evaluate the research and technical service activities of the Bureau and report their findings and recommendations annually. The Executive Committee studies these reports, identifies major problems in the technical program of the Bureau, particularly those common to several organizational units, and brings these problems to the attention of the Statutory Visiting Committee, which reports to the Secretary of Commerce. The reports of the panels and a summary report by the Executive Committee are published each year.

GEOPHYSICS RESEARCH BOARD

The Geophysics Research Board effects participation by U.S. scientists in the activities of international geophysical organizations and encourages research by U.S. scientists in geophysics and related fields. The Board's committees are the Balloon Study Committee, the Committee on Data Interchange and Data Centers, the Committee on Solar-Terrestrial Research, the Geophysics Study Committee, and the U.S. Geodynamics Committee.

The Balloon Study Committee reviewed past scientific achievements with balloons and specified the equipment and facilities needed to more fully exploit the potential of this economical means of obtaining high-quality scientific data.

The Committee on Data Interchange and Data Centers advises the Director of World Data Center A (the U.S. component of the World Data Center System) on policies and the effectiveness of services to the U.S. scientific community of the eight discipline-based subcenters and the Data Center Coordination Office that comprise the U.S. Center. The Committee's *ad hoc* Geophysical Data Panel completed a study of the impact of large-scale geophysical data-collection and monitoring programs on the World Data Center System and published its report (*Geophysical Data Centers: Impact of Data Intensive Programs*) early in 1976. The Committee is also studying magnetic observatories in relation to the needs and objectives of the International Magnetospheric Study and of space shuttle requirements.

Through its Panel on the International Magnetospheric Study, the Committee on Solar-Terrestrial Research is assisting with plans for redirecting the U.S. ground-based research program to make the optimum contribution to the Study. Other panels are assisting arrangements for U.S.-Peruvian cooperation in the support of the Jicamarca Radio Observatory and examining priorities in upper-atmosphere research.

The Geophysics Study Committee oversees a series of mini-studies in geophysics on such topics as energy and climate, geophysics of estuaries, water and climate, and geothermal energy. Each study considers the unity of geophysics, impact of technology on geophysics, international issues, and priorities. Publication of the first two studies is expected by fall 1976.

The U.S. Geodynamics Committee was formed to outline a U.S. program for the international Geodynamics Project; its recommendations have contributed significantly to the shaping of U.S. participation in this worldwide research program, which will end in 1979. Possible follow-on activities are being considered.

NAVAL STUDIES BOARD

The Board was established in 1974 to serve as an independent group to which the Navy could turn for outside counsel on areas involving the interplay of science and technology with other national issues. The first project undertaken by the Board was an assessment of the Navy's role in support of basic research and the ways in which the content, management, and use of its research program might be improved. The Board expects to complete its final report late in 1976. Most recently, the Board has been planning and organizing a summer study on "The Next Generation Navy: National Needs and Technological Opportunities," which will result in a report in late 1976. It is also coordinating a study that is being conducted by the Assembly of Life Sciences on the effects on man and ecological systems of the proposed Sanguine ELF (extremely low frequency) communication system (see page 91).

NUMERICAL DATA ADVISORY BOARD

The Board provides guidance to the Office of Standard Reference Data of the National Bureau of Standards on priorities and policies in the data-compilation effort and the coordination of this effort. Committees of the Board include the Committee on National Programs, which deals with scientific data problems and policy and is also concerned with education; the U.S. National Committee for CODATA (the ICSU Committee on Data for Science and Technology), which provides U.S. input into the programs and activities of that body; the Committee on Fundamental Constants; the Committee on Symbols, Units, and Terminology; and a new Committee on the Status, Needs, and Benefits of Data Compilation and Evaluation in Relation to the National Research and Development Effort.

During the year, the Board published the report of the Conference on Thermodynamics and National Energy Problems; advised the Office of Standard Reference Data on needs for evaluated phase diagrams for alloys and on the handling of Raman spectral data; initiated and coordinated a series of short courses for college faculty on data analysis and data quality; and cooperated with the Environmental Studies Board and the Committee on National Statistics in the formulation of a project on environmental monitoring for the Environmental Protection Agency. The Board also planned and served as host for the Fifth Biennial International CODATA Conference in Boulder, Colorado, in June 1976.

OCEAN SCIENCES BOARD

The Ocean Sciences Board was reorganized and transferred in part to the Assembly in late 1975. Its main objectives are to advance scientific understanding of the ocean, to encourage the application of scientific knowledge to the wise use of the ocean and its resources, and to facilitate communication among oceanographers. It also serves as the U.S. National Committee for the Scientific Committee on Oceanic Research of the International Council of Scientific Unions. Reports issued by the Board during the past year include: *Biological Oceanography: Some Critical Issues, Problems, and Recommendations* (see page 32); *Disposal in the Marine Environment: An Oceanographic Assessment; Numerical Models of Ocean Circulation* (the proceedings of a symposium held in October 1972), and *U.S. Directory of Marine Scientists: 1975.* The Board is organizing U.S. participation in the Joint Oceanographic Assembly that will be held in September 1976 in Edinburgh, Scotland. A new activity scheduled to begin in the new fiscal year is the Panel to Investigate Geological/Geophysical Research Needs and Problems of Continental Margins. The Panel will define roles for academic, industrial, and governmental organizations concerned with research on the U.S. continental margins, foster interaction among them, and advise on research planning and coordination.

OFFICE OF BIOCHEMICAL NOMENCLATURE

The Office is administered at the Oak Ridge National Laboratory under a subcontract between the National Academy of Sciences and Union Carbide Corporation. The Office disseminates information on the rules of chemical and biochemical nomenclature formulated by international commissions and advises and assists editors, authors of journal articles and textbooks, biochemical manufacturers, and others on the use of the internationally accepted nomenclature.

PLANNING COMMITTEE FOR A NATIONAL RESOURCE FOR COMPUTATION IN CHEMISTRY

The Committee's June 1975 report, *The Proposed National Resource for Computation in Chemistry: A User-Oriented Facility,* was reviewed by the National Science Board, which approved in principle the National Science Foundation's participation in the support of the Resource. Subsequently, provision was made in the Presidential Budget, released in January 1976, for joint support of the proposed National Resource by the Foundation and the Energy Research and Development Administration. As a next step in the planning process, the Committee has organized a set of eight concurrent workshops of specialists in relevant fields to discuss outstanding computational problems and to recommend priorities for the initial program of the National Resource. Following the workshops, the Committee will develop a comprehensive summary report on findings and recommended priorities.

POLAR RESEARCH BOARD

The Board's major functions are to advise the federal government on research in polar regions and to represent the United States in the activities of the ICSU Scientific Committee on Antarctic Research. The Board has standing committees on glaciology, permafrost, and international relations, as well as a number of *ad hoc* panels and study groups performing special studies on, for example, snow research and control, glacier and ice sheet sliding, offshore permafrost, and a research program for the proposed Nansen Drift Station. Its most recently initiated study will provide an evaluation of the National Science Foundation's Arctic Research Program. Among the reports issued by the Board during the past year is *Problems and Priorities in Offshore Permafrost Research.* The report points out that human activity can change physical characteristics of local permafrost-soil structure radically, thus posing substantial problems for construction engineering in regions now subject to resource development, notably hydrocarbon exploration, extraction, and transportation.

SOLID STATE SCIENCES COMMITTEE

In April 1976, a panel was established under the Solid State Sciences Committee to assess the national need for facilities dedicated to the production and use of synchrotron radiation. The panel has identified scientific opportunities that such sources would afford; potential user demand, including number of users, scientific disciplines they represent, and geographical location; and types of machines that would be most desirable. A preliminary draft by the panel was completed in June 1976, with publication of the final report expected in August 1976.

SPACE SCIENCE BOARD

The Board's principal function is to assist in shaping the most effective national program in space research. It also serves as the NAS representative to the Committee on Space Research (COSPAR) of the International Council of Scientific Unions and was host to the 1976 Plenary Session of COSPAR, held in Philadelphia in June 1976. For this occasion the Board organized a special symposium in which distinguished scientists representing countries active in space science spoke on new directions in space research and the particular goals of the countries they represented.

Operating under the Board are five major committees on planetary and lunar exploration, space astronomy and astrophysics, earth sciences, space biology and medicine, and space physics, as well as a panel on international relations.

In May 1976, the Board completed the 1975 updating of its earlier report on *Opportunities and Choices in Space Research.* It is organizing a summer study on the physics of space plasmas, and, in cooperation with the committee on Science and Public Policy and the Assembly Executive Committee, is planning a workshop for summer 1976 to explore the nature and functions of a proposed institute that would manage the scientific operations of the Large Space Telescope, and to consider the impact of such a facility on the future course of both space- and ground-based astronomy.

U.S.A. NATIONAL COMMITTEE FOR CRYSTALLOGRAPHY

This Committee maintains liaison with the International Union of Crystallography and nominates delegates from the United States to the triennial General Assemblies. It also sponsors symposia and conferences, usually held in conjunction with the national meetings of the American Crystallographic Association. In January 1976, this Committee and the Committee on Chemical Crystallography agreed to a merger under the title of the U.S.A. National Committee. The Committee on Chemical Crystallography had been principally concerned with the organization of symposia such as that on the interaction of computer science with experimental physical sciences, which took place in January 1976.

U.S. COMMISSION ON MATHEMATICAL INSTRUCTION

The Committee encourages U.S. participation in the International Mathematical Olympiads for high school students. It has been concerned with plans for the organization of the International Congress on Mathematical Education, scheduled for August 1976 in Karlsruhe, Germany.

U.S. COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP)

The GARP is an international effort jointly organized by the International Council of Scientific Unions and the World Meteorological Organization. Its objectives are to study the physical processes governing the transient behavior of the atmosphere and the statistical properties of the general circulation. Understanding of the former could lead to improved weather forecasting, perhaps ten days to two weeks in advance; the latter knowledge could lead to an understanding of climate and, perhaps, the ability to predict its fluctuations. Established in March 1968, the U.S. Committee for GARP is one of several national committees that guide the participation of individual countries in this international undertaking.

The U.S. Committee assisted in the planning of the GARP Atlantic Tropical Experiment and has since been planning for the First GARP Global Experiment. In cooperation with the Ocean Sciences Board, it formed a Joint Advisory Panel for the Global Experiment that is guiding the development of the NASA Data Systems Test program and developing plans for the management of the data derived from this Experiment. The Committee also took part in planning regional programs, such as the Monsoon Experiment and the Polar Experiment, the latter having been a joint effort with the Committee on Atmospheric Sciences, Polar Research Board, and Ocean Sciences Board. (Because of the emphasis on climate research, continuing work on the Polar Experiment will be supervised by the U.S. Committee for GARP.)

U.S. NATIONAL COMMITTEE FOR GEOCHEMISTRY

This Committee provides for U.S. participation in international activities in geochemistry through adherence to the International Association for Geochemistry and Cosmochemistry and promotes the advancement of geochemistry, nationally and internationally, through the conduct of studies, workshops, and conferences. Its Subcommittee on the Geochemical Environment in Relation to Health and Disease has sponsored three workshops—two concerned with the relationship of trace elements in the environment to disease, the third concerned with the distribution of trace elements related to the occurrence of certain cancers, cardiovascular diseases, and urolithiasis. A report of the first workshop has been issued; publication of reports of the other two is expected later in 1976. Plans are under way for additional studies on geochemistry of water in relation to cardiovascular disease, the geochemical environment and urolithiasis, aging and the geochemical environment, and geochemistry of coal resource development in relation to health.

U.S. NATIONAL COMMITTEE ON GEOLOGY

The Committee represents the United States in the programs and activities of the International Union of Geological Sciences and fosters U.S. participation in international programs in this field. It has three subcommittees, which also serve as U.S. national committees: the U.S. National Committee for the International Association of Hydrogeologists; the U.S. National Committee on the History of Geology (which is planning a conference on the first 200 years of geology in America, to be held in October 1976); and the U.S. Committee for the International Geological Correlation Program (which promotes interdisciplinary research in the geosciences among scientists of industrialized and developing nations).

U.S. NATIONAL COMMITTEE OF THE INTERNATIONAL ASTRONOMICAL UNION

Throughout the past fiscal year, the Committee has been planning for U.S. participation in the August 1976 General Assembly of the International Union and is administering a travel grant program for this meeting.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL COMMISSION FOR OPTICS

The Committee coordinates the activities of U.S. scientists and engineers in optics in furthering the objectives of the Commission and organizes U.S. participation in its activities. It was active in planning for the August 1975 International Congress and General Assembly of this Commission.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL GEOGRAPHICAL UNION

This Committee cooperates with professional geographical societies in promoting the advancement of geography nationally and internationally and provides for U.S. participation in the International Union. It has been active in planning for the July 1976 International Congress of this Union and is administering a travel grant program to assist U.S. participation.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF BIOCHEMISTRY

The Committee nominates U.S. delegates to the triennial General Assemblies of the International Union and cooperates in planning and preparing for other relevant international meetings and symposia. The Committee is assisting in plans for the Tenth International Congress of Biochemistry.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

The Committee assisted the American Geophysical Union in a travel grant program for the August 1975 General Assembly of the International Union. Currently, plans are under way for a joint general assembly of the International Association of Geomagnetism and Aeronomy and the International Association of Meteorology and Atmospheric Physics to be held at the University of Washington in 1977.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

For the 24th IUPAC Congress, which took place in Israel in July 1975, the Committee administered a travel award program. It also prepared a statement for presentation at the meeting of the IUPAC Council in September 1975 on a way that the International Union could direct some of its energy and resources to "Chemical Research Applied to World Needs." A subcommittee of the U.S. National Committee has been exploring ways in which the resources of chemistry could be used to benefit developing countries.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS

A major responsibility of the Committee is to assist in preparations for the triennial General Assemblies of the Union and for specialized meetings of the various IUPAP Commissions. The XV General Assembly took place in September 1975 in Munich. Recommendations for U.S. membership on the IUPAP Executive Committee and on all IUPAP Commissions were submitted by the Committee for consideration at this Assembly.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION FOR QUATERNARY RESEARCH

The Tenth International Congress of the International Union will take place in Birmingham, England, in August 1977. The U.S. National Committee is planning a U.S. exhibit and will administer a travel grant program for this Congress.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL UNION OF RADIO SCIENCE

This Union promotes the systematic study of radio science, fosters cooperation in international radio research, and facilitates agreement on common methods of measurement and the standardization of measuring instruments. The U.S. National Committee coordinates the activities of U.S. scientists and engineers in furthering these objectives and organizes U.S. participation in Union activities, such as the XVIII General Assembly, which was held in August 1975.

U.S. NATIONAL COMMITTEE FOR MATHEMATICS

The Committee provides for U.S. participation in the activities of the International Mathematical Union and fosters the advancement of mathematical sciences nationally and internationally. Currently, plans are getting under way for the 1978 International Congress of Mathematicians.

U.S. NATIONAL COMMITTEE FOR ROCK MECHANICS

This Committee reports on problems in rock mechanics research, provides for U.S. participation in international activities in rock mechanics, principally through adherence to the International Society for Rock Mechanics; and keeps the U.S. rock mechanics community informed about national and international activities in this field. The Committee organized a new program during the past year that is directed toward national concerns in which rock mechanics problems represent critical or limiting factors—for example, energy resources (including fossil, nuclear, and geothermal sources), tunneling and other forms of excavation, underground storage and waste disposal, and reactor siting.

U.S. NATIONAL COMMITTEE FOR THEORETICAL AND APPLIED MECHANICS

This Committee promotes the development of theoretical and applied mechanics as a branch of science, represents the United States in the International Union of Theoretical and Applied Mechanics, and acts as the central organization through which ten engineering, scientific, and mathematical societies with a common interest in mechanics can act on issues of mutual concern. The Committee sponsors the U.S. National Congresses of Applied Mechanics, provides liaison between U.S. and international organizations in theoretical and experimental work in mechanics and related sciences, assists in the organization of international congresses and symposia, and encourages cooperation in solid and fluid mechanics and related scientific fields among the relevant U.S. technical societies. The Committee served as host for the international symposium on "Structure of Turbulence and Drag Reduction" at the Academy in June 1976, and is administering a travel grant program to assist U.S. participation in the Fourteenth International Congress and General Assembly in The Netherlands in August 1976.

WORKSHOP ON THE COORDINATION AND PLANNING OF GEOLOGICAL AND GEOPHYSICAL RESEARCH ON THE CONTINENTAL MARGINS

Lack of understanding of the scope of federal agency responsibilities for research on the U.S. continental margins and of the parts that academic and industrial organizations can play in this area of research suggested that Academy sponsorship of a workshop to consider these problems would be productive. As a result, the Office of Earth Sciences of this Assembly took the lead in organizing such a gathering in March 1976 at the Marine Laboratory of the University of Texas. Discussions dealt with the scope of federal agency research programs and responsibilities for geological and geophysical research on the U.S. continental margins, opportunities for academic and industrial researchers, the need for long-range planning and improved coordination of research effort, and the establishment of research priorities. The workshop was successful in eliminating much of the misunderstanding and uncertainty about research needs and responsibilities and resulted in the creation, under the Assembly's Ocean Sciences Board, of a special panel to assist in long-range planning and facilitate interaction among the various organizations concerned with such research.

COMMISSION ON HUMAN RESOURCES

The Commission is concerned with those activities of the National Research Council that contribute to the more effective development and utilization of the nation's human resources, giving emphasis to national programs and needs in education and employment. Its concerns extend to policies in both the public and private sectors that bear directly upon human-resource development, and to the collection, analysis, and reporting of data on scientists, engineers, and other highly trained personnel. The Commission's work also includes concern for the institutions and processes through which the country's human resources are deployed. The Commission:

Maintains an overview of relevant work being done within NRC and elsewhere, those performing it, and its quality, determining thereby NRC program priorities in this area;

With the approval of the Governing Board of the National Research Council, receives and acts on requests by the federal government to investigate, examine, and report on matters related to human resources;

Works closely with other components of the NRC and with professional societies in addressing human-resource problems brought to the attention of the NRC;

Initiates new programs in its area of concern, working through its boards and committees, and oversees ongoing programs conducted under its aegis;

Fosters cooperation among scientists, engineers, government officials, and the public on national human-resource problems and facilitates the exchange of information;

Studies the education and utilization of women and minority-group members in science and engineering and makes recommendations for increasing their numbers and status in these fields;

Endeavors to make available to the public accurate, timely, and understandable information on the issues and problems with which the Commission deals.

To fulfill its role, the Commission coordinates the work of two boards and, in addition, conducts its own program of exploration and development through the Executive Director's Office. Three committees and several projects are established directly under the Commission to consider matters that do not fall within the purview of one of its boards.

BOARD ON FELLOWSHIPS AND ASSOCIATESHIPS (BFA)

Organized in 1974, the Board acts for the National Research Council in the conduct of the Graduate Fellowship Program and the Energy-Related Postdoctoral Fellowship Program of the National Science Foundation, the Fellowship Program of the International Atomic Energy Agency, the Postdoctoral Associateship Programs in 18 federal research organizations, and such other programs as the Board may devise in response to national needs.

The Board attempts to maintain the integrity of the selection process, participates in the formation of panels that evaluate applications, advises the NRC staff on policy matters concerning the Board's programs, monitors the results of evaluations of applications, and provides liaison with the academic and research communities in the conduct of the following programs:

NSF Graduate Fellowship Program and NSF Energy-Related Postdoctoral Fellowship Program

The National Research Council provides services to the National Science Foundation through the Fellowship Office in support of two NSF Fellowship Programs: the Graduate Fellowship Program and the Energy-Related Postdoctoral Fellowship Program. On behalf of the Board on Fellowships and Associateships, the Fellowship Office announces the competition for the fellowships, distributes application materials, processes applications, and arranges for their evaluation by panels of engineers and scientists appointed with the approval of the Chairman of the National Research Council, and communicates the results of the evaluations to the NSF. The NSF then makes awards based on the findings of the NRC panels and is responsible for the Fellows during their tenure.

In 1976, some 5,500 applications were evaluated by 105 panelists; fellowships were offered to about 500 finalists in the competition.

The number of applicants in the Energy-Related Postdoctoral Fellowship Program was 455 in 1976, compared with 332 in the previous year. Applications were reviewed by 45 panelists whose recommendations led to about 100 offers of awards this year by NSF. Publicity about the program was provided earlier than in fiscal year 1975, and the academic community has become more aware of the postdoctoral program, which had not been offered for several years.

Much attention is being given to the impact of the Privacy Act of 1974 on the Fellowship Program. In cooperation with the NSF, application materials have been revised to comply with the Act, and procedures are being strengthened for maintenance of the confidentiality of applications and for handling records.

In addition to providing evaluation services, the National Research Council also provides ancillary services to the NSF upon request. These include the maintenance and updating of the Cumulative Index (a long-term computerized record of NSF Fellows and Trainees), the maintenance and updating of an address file of academic officers, coding and data processing for NSF fellowship programs for which the NRC does not perform the evaluations, and the production of certain administrative rosters used by the Foundation.

Postdoctoral Associateship Program

This program is conducted by the Board on Fellowships and Associateships for 18 federal research organizations. In these programs, postdoctoral engineers and scientists receive temporary appointments in participating federal laboratories. To apply, candidates for associateships develop research proposals on topics of their own selection that are compatible with the general research interests of the federal agencies in which the applicants are interested. The awardees pursue their research in collaboration with research advisers in the host organization. By their work in the laboratories, the Associates provide stimulation to the professional staff and contribute to the research goals of the host laboratory. None of the research projects is classified.

In one type of Associateship Program, awardees receive temporary Civil Service appointments for one year (in some cases, appointments are extended for a second year). Agencies with this type program include: Agricultural Research Service, Bureau of Mines, National Bureau of Standards, Naval Medical Research and Development Command, Naval Surface Weapons Center, Naval Weapons Center, and U.S. Geological Survey. The appointments are based on NRC recommendations.

The second type of Associateship differs from the first principally in that the appointments are made by the NRC, which is also administratively responsible for the awardees during tenure. NRC appointees are currently on tenure at selected laboratories of: Air Force Systems Command, Environmental Protection Agency, Feltman Research Laboratory, National

Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, Naval Research Laboratory, U.S. Army Ballistic Research Laboratories, U.S. Army Natick Development Center, and Walter Reed Army Institute of Research.

The NRC monitors the Associateship Program through periodic visits to participating laboratories by NRC staff or by special NRC site visitors, who assess the status of postdoctoral opportunities in the federal setting and review the quality of the research by the Associates.

New additional programs, to begin in fiscal year 1977, will be conducted at the U.S. Army Construction Engineering Research Laboratory at Champaign, Illinois; the U.S. Army Medical Bioengineering Research and Development Laboratory at Ft. Detrick, Maryland; and the Armed Forces Radiobiology Research Institute, Bethesda, Maryland. These additions to the Associateship Programs will provide another 15–20 research opportunities a year for postdoctoral scientists and engineers.

BOARD ON HUMAN-RESOURCE DATA AND ANALYSES

The Board collects and analyzes data relevant to issues of human resources supply and demand and to the formulation of related public policy. It sponsors research on the effect of government programs in the area and works with other NRC units, professional societies, educational associations, and federal agencies to improve the procedures by which human-resource data are collected and utilized. Special emphasis is given to data about scientists and engineers. This is an area in which many organizations, professional and governmental, have an interest and with which the NRC Assemblies and other Commissions are also concerned. Confidentiality of data and compliance with the Privacy Act of 1974 are of special concern to the Board.

The Board administers several ongoing programs: Doctorate Records File, Comprehensive Roster of Doctorate Recipients, the Study of Environmental Manpower, and the Study of Effects of Postdoctoral Associateship Programs. A report entitled *A Century of Doctorates* is being prepared.

The Doctorate Records File

The Board provides program and policy guidance for the annual Survey of Earned Doctorates and the resultant Doctorate Records File—a computerized record of more than half a million doctorate recipients from U.S. universities from 1920 through 1975. It does not include such professional degrees as the M.D., D.D.S., and D.V.M. The File is a unique source of information that is used in a variety of special studies and research projects.

In 1975, 32,913 doctorate records were added to the File. The decrease in the annual number of doctorates granted, which began in 1974, leveled off in 1975. The 1974 figure was 2.2 percent less than in 1973, and the 1975 figure was only 0.3 percent less than in 1974.

Information for the Doctorate Records File is obtained from questionnaires that are distributed with the cooperation of deans of graduate schools and filled in by the graduates when they complete all requirements for their doctoral degrees. Data are provided about date and place of birth, sex, citizenship, marital status, racial or ethnic group, educational background from high school to doctorate, sources of financial support in graduate school, and postgraduate plans. Each spring a Summary Report is published providing tabulations of these data for the prior year.

Comprehensive Roster of Doctorate Recipients

Through its Comprehensive Roster of doctorate holders, the Board makes available statistical tables and analyses of data about doctorate recipients from U.S. universities in science and engineering. The Roster covers the period, 1930 through 1975. Included in the Roster, also, are people in the United States who hold science or engineering doctorates from foreign universities and people working in science and engineering fields with doctorates in nonscience fields. A sample from the Roster is surveyed every other year (Survey of Doctorate Recipients) to provide current statistical data about the composition and utilization of the doctoral population. A summary of the first survey (1973) was published in March 1974, and an analytical report on field mobility was published in February 1976. The second survey (1975) has been completed.

The Roster is now being extended to include doctorate recipients in the humanities. Aside from providing current and statistically reliable information about the doctoral population in these disciplines, the addition will make possible a more comprehensive description of human resources at the doctoral level. The extension offers a means for providing an important and hitherto missing segment of such information to meet the needs of federal and state governments, universities, professional associations, and other organizations.

Committee for Study of Environmental Manpower

The study is part of a large project being carried out by the National Research Council for the Environmental Protection Agency (EPA) and stems from a Congressional mandate to EPA. It is coordinated with studies by other NRC units through the Commission on Natural Resources.

The study by this Committee is concerned with national requirements for scientific and technical manpower in the period from the present to 1985. The Committee is developing a profile of manpower requirements, examining sources of manpower, and considering ways in which people with scientific and technical competence are brought into the work on environmental problems. Major factors that affect the demand for environmental manpower include emerging technology and changing patterns of federal, regional, state, and local funding, requirements, and cooperation. Training needs at all significant levels are being analyzed and the processes involved in recruitment for manpower-short fields are being examined. The Committee is also analyzing the interaction between EPA and educational institutions, including exchange of scientific and technical personnel and trainee funding. The Committee's report is scheduled for publication by the end of December 1976.

Publication of Doctoral Data: "A Century of Doctorates"

This project entails the preparation of the seventh book in the series on doctorate production and baccalaureate origins of Ph. D.s, the most recent of which was published in 1967. Included will be a brief historical review, going back to about 1880 and giving numbers of Ph. D.s by year, as well as breakdown by field for more recent years.

The book will deal with characteristics of doctoral institutions (including numbers of Ph. D.s awarded by field and sex of the recipients); an analysis of characteristics of doctorate recipients (demographic and educational characteristics and plans for employment or further training); and will present tables showing institution, Ph. D. and baccalaureate degree, age at Ph. D., postgraduate plans for training and employment, and geographic distribution. An annotated bibliography will list the various Commission on Human Relations studies of doctorate holders, as well as studies done elsewhere.

In conjunction with the tabulations prepared for *A Century of Doctorates,* the project includes a preliminary study of the effect of NSF fellowships and National Defense Education Act fellowships on the careers of scientists, engineers, and scholars. NSF expressed an interest in an evaluation of the outcomes of their Graduate Fellowship Program similar to, but more limited than, that prepared by the Commission for the National Institutes of Health. Career outcomes will be assessed by the following criteria: attainment of Ph. D., research grants, attainment of thesis adviser status, and publications and citations. A report will be prepared on the results of this preliminary study, and plans will be made for a more comprehensive study to address policy issues.

Study of Effects of Postdoctoral Associate Programs for Federal Laboratories

A study is being carried out on the impact of the NRC Postdoctoral Associateship Programs on the scientific research accomplishments of the participants. The careers of the Associates will be described and procedures developed to obtain similar information for individuals receiving fellowships under other programs and for unsuccessful applicants for associateships. The Research Associateship Programs, which have been in operation since 1954, have supported more than 2,000 scientists who have had postdoctoral training in government laboratories under one or another of the programs administered by the National Research Council.

Study of Faculty, Postdoctorals, and Doctoral Research Staff in Science and Engineering

The Commission is planning a study of scientists and engineers, engaged in basic and applied research, to measure the extent to which changing funding levels and changing employment opportunities have affected the viability of established career patterns and to suggest possible new patterns of employment to ensure the continued vitality of research. The study will focus chiefly on doctoral researchers at early stages of their careers in the universities, including faculty, postdoctorals, and professional research staff. Attention will also be paid, however, to researchers in later career stages and in other sectors to develop a better understanding of the opportunities for migration between universities and other sectors and to explore opportunities for collaboration.

SPECIAL STUDIES

Committee on a Study of National Needs for Biomedical and Behavioral Research Personnel

In response to the National Research Service Award Act of 1974, this Committee prepares annual reports for the Secretary of Health, Education, and Welfare, for communication to the Congress, concerning the nation's overall need for biomedical and behavioral research personnel, the areas in which such personnel are needed, and the kinds and extent of training that should be provided. The Act also specifies consideration of the current training programs available for biomedical and behavioral research personnel, the extent to which non-federally supported programs are adequate to meet established needs, and identification of the kinds of research positions available to and held by individuals completing such programs. The Committee submitted its first annual report to the Secretary of HEW in June 1975. The 1976 report was submitted to the Secretary on May 7, 1976.

The Committee now plans to make the following studies: specification of the population of health-related researchers, utilization of the Ph.D. labor force (enrichment, mobility), modeling and simulation of supply and demand, student support and institutional financing, alternative mechanisms of support, definition of the population of clinical investigators, identification of emerging fields, productivity of researchers, and monitoring the labor market and providing career guidance.

National Board on Graduate Education

This Board was established in 1971 by the Conference Board of Associated Research Councils (American Council on Education, American Council of Learned Societies, National Research Council, and Social Science Research Council) to provide a means for analysis of graduate education today and its relation to American society in the future. The Board is administered by the Commission on Human Resources. The Board completed its studies with the publication of two reports: *Outlook and Opportunities for Graduate Education,* published in December 1975, and *Minority-Group Participation in Graduate Education,* published in June 1976

Committee on the Education and Employment of Minority-Group Members in Science

The Committee is concerned with problems of access, entry, retention, progress, and development to the fullest extent possible of members of minority groups in science. The Committee works closely with the Committee on Minorities in Engineering in the Assembly of Engineering. At its first meeting in November 1975, the Committee reviewed the report of an earlier ad hoc conference group, discussed priorities and plans for future projects, and reviewed minority-related projects being conducted by other organizations. Subcommittees were appointed to deal with precollege education, minority institutions, and the role of government. In May 1976, the Committee reviewed reports of its subcommittees and established priorities for its work.

Committee on the Education and Employment of Women in Science and Engineering

The Committee was established in December 1974 to examine the social, structural, and institutional constraints that limit the participation of women in science and engineering, giving special attention to problems of sex discrimination in education and employment. The Committee will seek to increase official and public understanding of these issues and serve as a focus for efforts to improve the educational and employment opportunities in science and engineering for women. A position paper has been drafted that highlights some of the needs and problems of women in science and engineering and recommends programs to promote necessary changes in attitudes and educational and employment patterns.

INTERNATIONAL ACTIVITIES

Senior Fulbright-Hays Program

The Council for International Exchange of Scholars (until late 1973 the Committee on International Exchange of Persons) was established in 1947 by the Conference Board of Associated Research Councils (American Council on Education, American Council of Learned Societies, National Research Council, and the Social Sciences Research Council) to administer national competitions for Fulbright awards for university lecturing and advanced research abroad and to sponsor visiting Fulbright scholars in the United States. The Academy, acting on behalf of the Conference Board, has had the administrative and contractual responsibility for the Program over the past 28 years. In February 1975, the Department of State announced its intention to transfer the contractual responsibility for the Senior Fulbright-Hays Program from the National Academy of Sciences to the American Council on Education on or before December 31, 1975. This transfer was effected on November 24, 1975.

A final report, *Stewards for International Exchange—The Role of the National Research Council in the Senior Fulbright-Hays Program, 1947–1975*, was published by the Commission on Human Resources on April 30, 1976.

International Atomic Energy Agency (IAEA) Fellowships

In this program, training opportunities are provided for citizens of developing countries in the use of nuclear energy for peaceful purposes and in the use of radiation and radioactive materials for medical, biological, agricultural, and industrial purposes. The Fellows are selected by IAEA from candidates nominated by eligible member states.

Through the Fellowship Office, NRC arranges study programs for the Fellows for whom the United States is host. Various organizations cooperate with the NRC in placing the Fellows, including colleges and universities, hospitals, government agencies, and private corporations.

The IAEA Fellowships are supported by the General Fund of IAEA and the United Nations Development Program. Fellowships are also contributed by member states of the IAEA in order to provide training for students from developing countries in universities and other institutions of these member states. Funds are provided under an annual contract with the Energy Research and Development Administration to cover NRC costs in conducting this program in the United States.

In recent years, about 125 IAEA awardees have been on tenure in the United States each year.

COMMISSION ON INTERNATIONAL RELATIONS

The activities of this Commission are reported in Part II of this report under International Activities (see page 47).

COMMISSION ON NATURAL RESOURCES

The Commission was established in 1973 as a major component of the National Research Council, primarily concerned with natural resources and environmental quality. Natural resources policy is an ingredient in some of the most complex decisions encountered by modern society, and accurate and timely scientific information is required for rational debate about means of reconciling conflicting demands on natural resources. Innovative options to meet the needs for resources must be identified or devised, and assessments of the impacts of alternative courses of action must be presented to the public and to political decision-makers.

The Commission serves in response to these needs. Under the supervision of the Commission, analytical and advisory studies in the broad area of natural resources and environmental quality are carried out by voluntary committees and panels of experts selected to bring the best available competence to bear on each problem.

The Commission oversees the work of four Boards and selected Special Projects. The four standing Boards at the end of fiscal year 1976 were: Agriculture and Renewable Resources, Energy Studies, Environmental Studies, and Mineral Resources.

STEERING COMMITTEE FOR ANALYTICAL STUDIES FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

As a special project initiated for EPA in June 1974, this Committee is coordinating a series of analytical studies on the general theme of acquisition and use of scientific and technical information in environmental regulatory decision-making. The specific studies in the program are:

Environmental Decision-making;
Environmental Research Assessment;
Study of Environmental Manpower;
Environmental Monitoring;
Energy and the Environment;
A Multimedia Approach to Municipal Sludge Management;
The Acquisition and Use of Scientific and Technical Information in Pest Control Regulatory Decision-making at the Federal and State Levels; and
Societal Consequences of Transportation Noise Abatement.

The Steering Committee coordinates these projects and will prepare an overview synthesis as a final report.

COMMITTEE ON REMOTE SENSING PROGRAMS FOR EARTH RESOURCE SURVEYS

During 1976 the Committee completed an evaluation of the THEMATIC MAPPER, a NASA-proposed design for a follow-on sensor system to the present LANDSAT 1 and 2 series. The proposed design of the THEMATIC MAPPER was optimized for sensing land cover and vegetation.

The Committee recommended changes to the spectral bands and the time-of-day for sensing which should increase the utility of the data to other segments of the user community (including mineral exploration, coastal processes, coastal zone management, water resource management, and land use management) without appreciably degrading the effectiveness of the sensor for land cover and vegetation sensing.

A preliminary report on this evaluation was provided to NASA and those federal agencies that have a user-interest in remote sensing for earth resource management and environmental monitoring. A final report of this evaluation will be published by September, 1976.

COMMITTEE ON MINERAL RESOURCES AND THE ENVIRONMENT

This Committee phased out its activity in February 1976 after issuing three supplmentary reports to its earlier main report, *Mineral Resources and the Environment.* The supplementary reports, *Reserves and Resources of Uranium in the United States* (see page 28) and *Resource Recovery from Municipal Solid Wastes,* were issued in December 1975; and the supplementary report, *Coal Workers' Pneumoconiosis—Medical Considerations, Some Social Implications* (see page 27), was issued in February 1976.

BOARD ON AGRICULTURE AND RENEWABLE RESOURCES

The Board was established in 1973 to keep abreast of developments in agriculture (plant and animal), and renewable resources, land and water use, forestry, fisheries, wildlife, and rural development. The Board is alert to emerging opportunities and potential problems, and is responsive to requests for advice from pubic agencies and private organizations.

U.S. Food Production

In response to President Ford's request to President Handler for NRC assistance in mobilizing the U.S. potential for food production, the Board organized workshops to prepare a report, *Enhancement of Food Production in the United States* (see page 15), issued in November 1975.

Renewable Resources for Industrial Materials

The Committee on Renewable Resources for Industrial Materials examined the role of renewable resources in meeting the nation's future needs for materials, identifying the optimum production and use of such resources and determining the role of science and technology in overcoming barriers to their production and use. Panels organized under the Committee considered utilization, productivity, systems analysis, economic and institutional factors, and international aspects. A report for the Science and Technology Policy Office of the National Science Foundation has been prepared for publication in mid-1976.

Changing Climatic and Weather Fluctuations and Their Effect on Agriculture and Renewable Resources Production

This one-year study assessed the changing climatic patterns and weather fluctuations and their impact on agricultural and renewable resource production and the technology and research strategies necessary to offset the stresses of these changes in order to optimize agricultural and renewable resource production. The report of this study, funded by the National Science Foundation, was published in July 1976.

Jojoba Production System Potential

The Board has conducted a study for the Office of Native American Programs of the Department of Health, Education, and Welfare to establish the research and development requirements for the agricultural production of jojoba, and has determined that it will take from five to seven years for the Indians to establish plantations to make them profitable. Publication of this study's report is anticipated in September 1976.

Acquisition and Use of Scientific and Technical Information in Pest Control Regulatory Decision Making at the Federal and State Levels

This study for the Environmental Protection Agency is assessing the role of science and technology in regulatory decision-making, and the impact of policies and regulations at the federal, state, and international levels on pesticides and pest-control mechanisms. The Committee is reviewing the role of scientists and technicians in implementing the Federal Environmental Pesticide Control Act and the complementary roles of the legal and administrative communities. Publication of the report is expected in mid-1977.

Committee on Animal Nutrition

This Committee is concerned with all aspects of animal nutrition and the interrelationships of animal nutrition with human health and the agricultural enterprise. Reports published during the year include: *Urea and Other Nonprotein Nitrogen Compounds in Animal Nutrition, The Effect of Genetic Variance on Nutritional Requirements of Animals, Fat Content and Composition of Animal Products,* and *Nutrient Requirements of Beef Cattle, 5th Revised Edition.*

BOARD ON ENERGY STUDIES

The Board was established in 1974 to serve as a focal point within the Commission on Natural Resources on matters involving energy as a resource and its impact on the environment. The Board is charged with maintaining a continuing assessment of the adequacy of present and projected resources and associated technology in meeting our energy needs. This requires that the Board maintain a current awareness of energy use and conservation practices, safety and environmental requirements, and the national energy policies and programs as they may affect the future energy supply and demand.

Committee on Radioactive Waste Management

Because of the increased number of federal agencies having responsibilities or interest in radioactive waste management, the Committee on Radioactive Waste Management was reorganized and expanded in fiscal year 1976 to include a broader range of scientific and technical disciplines. Active liaison has been established between the Committee and the Energy Research and Development Administration, the Nuclear Regulatory Commission, the Council on Environmental Quality, the Environmental Protection Agency, the National Science Foundation, and the U.S. Geological Survey. Some of these interactions are expected to result in requests during the coming year to study additional problems of concern to one or more of these agencies.

During fiscal year 1976, the Committee's Panel on Land Burial completed its investigations of the problems associated with shallow land burial of solid low-level radioactive waste. This problem is of particular technological and environmental significance because although such waste includes a small fraction of the total amount of waste radioactivity, it accounts for a large fraction of the total volume and mass of such material, and requires special techniques for handling and disposal. The report will be published in the fall of 1976.

At the request of the Energy Research and Development Administration and the Council on Environmental Quality, a Panel was formed to conduct an independent review and evaluation of the Hanford radioactive waste management practices and plans. The studies will include investigations of both high-level and low-level radioactive waste now stored at Hanford and its present and anticipated environmental effects. The results of these studies should assist the federal government in formulating its plans for the management of the Hanford radioactive wastes and radioactive wastes now being generated by the commercial nuclear power industry.

Committee on Energy and the Environment

The Committee's study, conducted for the Environmental Protection Agency, is concerned with the review and assessment of the relationships, impacts, and trade-offs between environmental regulation and the various aspects of energy production and consumption, with consideration to economic and social factors. The report should assist EPA, as well as legislative and regulatory agencies, in their regulatory decision-making activities.

Committee on Chemistry of Coal Utilization

The Committee, established in 1975, is preparing the manuscript for the second updating supplement to reference text, *Chemistry of Coal Utilization,* originally prepared in 1945 and supplemented in 1963 by National Research Council committees. The Committee, with the assistance of a technical editor, has drafted an outline and selected individuals, knowledgeable in specific subject areas, to author 31 chapters. Each chapter will carry its subject technology from 1963 to the present time by a critical review of the literature covering this period of time. The manuscript will be completed in January 1978.

ENVIRONMENTAL STUDIES BOARD

The Board was established in 1967 as a joint activity of the National Academy of Sciences and the National Academy of Engineering, and was reconstituted in 1973 as a constituent unit of the Commission on Natural Resources. It initiates, conducts, coordinates, and reviews studies in the area of environmental quality and natural resources management, seeking to resolve scientific issues arising out of conflicts between developmental and environmental values. In 1976, the Board completed work on two projects, continued work on four other projects that were underway at the beginning of the year, and started four new ones.

Pest Control Technology Assessment

A study of Contemporary Pest Control Practices and Prospects was initiated in 1972 with funds provided by the Ford Foundation. Additional funds were provided by the U.S. Department of Agriculture and the Environmental Protection Agency. Four study teams reported on pest control practices for corn and soybeans, cotton, forests, and public health. Their reports, together with the overall summary report of the Committee, were completed during the year and published in February 1976.

Study Committee on Water Quality Policy

The work of this committee culminated in January with the committee's comments on the National Commission on Water Quality staff draft report and the subsequent publication of the Committee's own background data under the title *National Residuals Discharge Inventory.* Both reports were published by the NCWQ through the National Technical Information Service. In addition the Committee reviewed a number of reports prepared for NCWQ by its contractors and met with the Commission staff on several occasions to discuss critical issues. A panel of the study Committee, working jointly with a panel appointed by The Institute of Ecology, also completed a report for NCWQ on *Methods for Aquatic Ecosystem Analysis.*

International Environmental Programs Committee

This Committee was established in 1969 in response to a suggestion by the Department of State that the Academy provide interdisciplinary advice to the U.S. Government on international environmental problems and U.S. initiatives at international conferences. It also serves as the U.S. National Committee for the Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions. During the past year, the Committee has concentrated primarily on providing U.S. involvement in and support for the SCOPE mid-term program. A report evaluating the Global Environmental Monitoring System, a part of the United Nations Environmental Program's Earthwatch, was completed and a draft of a report to SCOPE was prepared. The program was funded in 1976 by the Andrew Mellon Foundation, the Rockefeller Foundation, the National Science Foundation, and the National Oceanic and Atmospheric Administration.

Committee on Environmental Decision-Making

The Committee was formed jointly by the Environmental Studies Board and the Committee on Public Engineering Policy to conduct a major study for the Environmental Protection Agency under the program of analytical studies of that agency. Recommendations will be developed on how to make more effective use of scientific, technical, and economic data and analysis in environmental decision-making. The Committee has created four panels to examine the adequacy of benefit/cost analysis and other evaluative and integrative procedures; the effects of statutory language and judicial review; the use and adequacy of scientific and technical information; and the effects of economic, social, political, and administrative considerations involved in environmental decision-making.

Environmental Research Assessment Committee

This Committee, supported by the Environmental Protection Agency under the contract for analytical studies, is studying research needed to support decision-making for environmental regulation. Four panels were formed to assess fundamental research opportunities in the following areas: identification of pollution sources and techniques for abatement and control; fates of pollutants in the environment; effects of ambient environmental quality on human beings, plants, animals, ecosystems, inanimate objects, and weather and climate; and environmental impacts of management of renewable and non-renewable resources. The Committee is assessing mechanisms for establishing research priorities, coordinating and managing research programs, and assuring quality work in both in-house and extra-mural research.

Environmental Monitoring

The ESB is participating with the NRC Committee on National Statistics and the Numerical Data Advisory Board in a study of environmental monitoring. The study is administered by the Committee on National Statistics in the Assembly of Mathematical and Physical Sciences (see page 104).

Committee on Sludge Management

This Committee is taking a multimedia approach to municipal sludge management problems. It is examining the alternatives for disposal and use of municipal sewage sludge, considering existing institutional constraints and decision alternatives faced by the Environmental Protection Agency. Human health, technological, legal, economic, and social factors are being examined to provide a basis for recommending appropriate procedures to EPA for arriving at the most suitable sludge management alternatives.

Scientific and Technical Assessment of Environmental Pollutants

As part of its program on Scientific and Technical Assessment Reports on pollutants, the Environmental Protection Agency asked the National Academy of Sciences, in June 1975, to prepare several background documents on potential pollutants. During the year, the Academy and EPA agreed to make studies of low-molecular-weight halogenated hydrocarbons and nitrates. A coordinating committee and two panels were established. A mass balance approach will be taken and the feasibility of controlling the pollutants and the costs and benefits derived from regulation will be considered. The coordinating committee will also prepare a report on methodology of making such studies.

Judicial Decision Making

With funding from the Scaife Family Foundation, a planning group is making case studies looking to the evolution of a proposal for government funding for a study of the adversary process in judicial decision-making, with land-use decisions as a potential focus.

Water Pollution Abatement Review

The Study Committee on Water Quality Management began work on a final review of its position on water pollution control policy. Work is to continue in the 1977 fiscal year.

BOARD ON MINERAL RESOURCES

This Board of the Commission on Natural Resources supersedes the Committee on Mineral Resources and the Environment which phased out its activities in February 1976. Board responsibility, as set forth in its charter of July 1974, centers on the science, technology, economics, industrial activity, educational programs, and governmental policies and practices related to hydrocarbon, metallic, and nonmetallic mineral resources, including water.

Gas Reserve Estimation

In response to a request from the U.S. Geological Survey, a panel was formed to conduct an evaluation of the estimating techniques and procedures and of the gas reserve estimates for a representative sample of producible shut-in leases on the outer continental shelf which had been reported in an analysis by the Federal Power Commission. The panel's report was issued in March 1976 (see page 30).

Gas from Unconventional Geologic Sources

With support from the Energy Research and Development Administration, the Board held a one-day forum in January 1976 on the methane production potential from coal deposits, shales, tight sands, and geopressured zones. In its March 1976 report on the forum, the Board concluded that total resource figures are highly speculative and much work must be done to produce even marginally acceptable estimates, that methane from these sources will not be cheap nor easy to produce, that the level of funding devoted to investigating new sources of methane has been miniscule, and that knowledge of the geology, possible production technology, and extent of the resource is fragmentary.

Directions and Priorities in Mineral Resources

Under this program, the Board will identify, investigate, and report on two mineral resource topics considered to be of national importance and prepare a report presenting an overview outlining trends, developments, and auxiliary impacts of central issues and staging requirements in mineral resources. Funding is provided by the U.S. Bureau of Mines and the U.S. Geological Survey.

Accessory Elements and Ore Production

The Board is conducting a study of the potential production and distribution of accessory elements and compounds associated with the anticipated increase in the scale of mining for certain minerals and the exploitation of new deposits of varying type and grade, including ore treatment processes. In addition to coal, oil shale, and iron ores, uranium ores and potential aluminum ores will be reviewed. The study will assess the state and needs of the information base and review projection of environmental loading of mobilized chemical species. In addition to the U.S. Bureau of Mines, which requested the study, support has been obtained from the U.S. Geological Survey and the Environmental Protection Agency.

Geological Information Generation

The Board proposes to examine the geologic information requirements for a vigorous national resources program. It plans to conduct an independent review of the current and projected roles of the principal organizations that produce and accumulate such data used in mineral-resource activities. It would develop an overview of needs and activities and develop recommendations to insure that the present and planned geologic data-generating programs conducted by key elements of the mineral-resources effort can in fact help the nation achieve a more effective use of the domestic resource base. The BMR will: (1) Review the nature, scope, and level of geologic survey, geological research, and mineral-resources appraisal carried on by governmental agencies at both federal and state levels, and that done by industry and universities. (2) Review the adequacy of governmental and private geologic research for providing the basic scientific data required to support effective national mineral-resources programs. (3) Review the nature of and the responsibilities for long-term program planning in geologic and mineral-resources research by government agencies. (4) Review governmental research and development activities in mineral-resources appraisal. (5) Review the individual and cooperative activities of universities, industry, state geological surveys, the U.S. Geological Survey, and other federal agencies (regulatory, environmental, etc.) that contribute to the efforts to resolve national mineral-resources problems.

COMMISSION ON SOCIOTECHNICAL SYSTEMS

The Commission is concerned with current and potential large-scale physical, technological, and industrial systems that serve or directly affect the public. The Commission's studies are assigned to boards and committees in several broad program areas: Transportation; Housing, Building, and Urban Design and Development; Materials; Public Facilities Networks; Communications and Information Processing; Contingency Planning and Emergency Services; and Energy Conservation and Utilization.

TRANSPORTATION RESEARCH BOARD

The Transportation Research Board (TRB) administers two major programs: Regular Technical Activities and Cooperative Research Programs. The first program includes the work of some 170 standing committees dealing with the full spectrum of transportation problems, the conduct of seminars and workshops, and an extensive program of technical information transfer. The second program includes the National Cooperative Highway Research Program, which is designed to permit state governments to pool resources for research on problems in highway transportation.

The collection and dissemination of transportation research information through the development and operation of data processing systems is a major TRB activity. Computer-based information on completed and ongoing research is provided by the Highway Research Information Service, the Air Transportation Research Information Service, the Railroad Research Service, and the Maritime Research Information Service (operated by the Maritime Transportation Research Board in cooperation with TRB). Information is also disseminated through TRB's extensive publications.

During the year, the TRB sponsored a series of 20 workshops to develop and exchange new ideas and to assess major national and international problem areas in transportation. The TRB is concerned with all aspects of land and air transportation, including highway research, railway research, transportation-related land-use, environmental impacts of transportation systems, legal aspects, economics, management, urban planning, and costs and benefits to society. Topics covered in the workshop series ranged from railroad transportation research needs to concrete pavement design.

In addition to the workshops, TRB organized a Conference on Urban Transportation Alternatives to obtain the views of the transportation community on draft guidelines for urban transportation planning that had been prepared by the Urban Mass Transportation Administration (UMTA) of the Department of Transportation. In a departure from its usual procedure of publishing proposed guidelines in the Federal Register and then seeking comments, UMTA asked TRB to give the guidelines wide exposure among transportation professionals in advance of publication in the Federal Register.

MARITIME TRANSPORTATION RESEARCH BOARD

In January 1976, the Maritime Transportation Research Board (MTRB) published the report, *Toward an Improved U.S. Merchant Marine: A Recommended Program of Studies.* The report is concerned primarily with the factors inhibiting growth in the U.S. merchant marine, including the loss of position in world shipping markets and the flow of U.S. capital to foreign-flag services. The report deals with areas of research that might lead to removal of institutional barriers that now constrain the industry from realizing its full potential.

More recently, MTRB published *Port Development in the United States,* which points out that funds for port development from traditional sources are likely to become increasingly scarce in the next decade, and urges the establishment of a federal aid-to-ports program if U.S. ports are to continue to perform their vital economic and national security functions.

The maritime industry is undergoing a technological revolution that is revitalizing its operations with new ships and systems. MTRB is forming the National Maritime Research Strategy Committee to identify and analyze methods for introducing and managing maritime research; to identify changes that will require technical support, based on forecasts of transportation and world economics; to set forth alternative research objectives and priorities; and to identify restraints to technical improvement. The changing technology of the maritime industry is also placing new and more sophisticated skill requirements on the personnel who operate and manage the shipyards of the United States. The MTRB Committee on Personnel Requirements for an Advanced Technology will examine requirements for education, skill levels, and manning to make full use of advanced technology in ship construction and design.

The Panel on Impact of Marine Services on Local Populations is examining means to accommodate local populations that have been or may be adversely affected by maritime-related services. Despite broad benefits to the general public from improvements in marine services, people who see their environment, neighborhood, or employment threatened will resist change unless means are found for solving their problems or allaying their fears.

Plans are being made for a Conference on National Maritime Cargo Issues, with broad participation by industry, academia, and government, that will concentrate on such issues as bilateral trade agreements, pricing of international cargo services, pooling arrangements, subsidization, and regulation. Also being planned is a symposium on "Productivity/Energy," to be held in 1977.

In addition to its technical reports and special study reports, MTRB maintains the Maritime Transportation Research Information Service—

the maritime equivalent of the Transportation Research Board's information systems. TRB provides the computer software services for the MTRB maritime information specialists. An annual cumulative index is planned by MTRB.

Established a number of years ago, the MTRB Ship Research Committee advises the Ship Structure Committee (a federal interagency committee) on research to improve ship hull structures. The interagency committee represents the Naval Sea Systems Command, the Military Sealift Command, the Maritime Administration, the U.S. Coast Guard, and the American Bureau of Shipping.

ADVISORY BOARD ON MILITARY PERSONNEL AND SUPPLIES

This Board advises the U.S. Army Natick Research and Development Command on research and development programs and problems concerned mainly with feeding, clothing, and protecting military personnel in any type of environment.

Most of the Board's committee activities during the year were concerned with Natick's efforts in support of the Department of Defense Food Research, Development, Testing, and Engineering Program. Other Natick projects assisted by the Board include the development of a new infantry helmet and Natick's process of enzymatic hydrolysis of cellulosic materials to glucose.

Widespread interest in potential applications of enzymatic conversion of cellulosic waste materials into energy-rich foods, clean fuels, and scarce-supply chemicals was demonstrated at a symposium on "Enzymatic Conversion of Cellulosic Materials: Technology and Applications," held in September 1975. Approximately 330 people attended—more than 75 percent from industry and about 35 representatives of foreign countries—to learn of the process and, more importantly, to discuss the industrial possibilities of the conversion of cellulosic materials into useful, profitable products. The process shows promise as a means of removing certain solid wastes and producing valuable chemical and food bases, although it was pointed out that further engineering and economic refinements are needed. The Committee on Pollution Abatement and Resources Recovery has been asked to assess the status of the process and of enzymatic conversion technology in general to determine whether Natick's process is ready to be transferred to private industry or appropriate public agencies. A report is being prepared.

NATIONAL MATERIALS ADVISORY BOARD

The activities of the National Materials Advisory Board (NMAB) cover the entire life cycle of materials, from their origins at the natural resource level through their applications in useful products to their disposal or reclamation back into the materials cycle. Although the bulk of NMAB work is related to technical problems, the Board also undertakes studies of materials-related social problems. The Board now has 24 active committee and panel programs, most of which are grouped in three main areas: defense and aerospace, critical and strategic materials, and health and safety as related to materials.

Two NMAB reports received widespread attention during the year. The first, *Problems and Legislative Opportunities in the Basic Materials Industries,* was an attempt to assess the present state of the materials industry in the United States and to identify some of the problem areas that might conceivably be alleviated by legislative action. In general, it was concluded that innovativeness in the U.S. materials industry has declined in recent years, largely because of shifts in the political climate, uncertainty about future environmental requirements, and, in some instances, declining profitability of certain industries.

The second report of interest was the *Report on Fire Safety and Fire Hazards Related to Polymeric Materials in Washington Metropolitan Area Transit Authority* (*WMTA*). This study was undertaken as a public service to evaluate fire safety problems that might exist in WMTA rail car interiors. It was concluded that more adequate consideration should have been given to fire safety at the time the cars were designed. The report is expected to have a significant impact on the future design of other transit systems.

Also in the area of hazardous materials, the Committee on Evaluation of Hazardous Materials in an Industrial Environment is conducting a study for the Occupational Safety and Health Administration to define the physical and chemical nature of vapors and dust atmospheres in the workplace environment and their hazards in the presence of electrical equipment. A continuing program on the Fire Safety Aspects of Polymeric Materials is concerned with the technology of fire-retardant and fire-suppressant polymeric materials as they are used in aircraft, ground transportation, marine transportation, buildings, and other uses, such as tents.

Another NMAB committee completed a report that deals with advances in the technology of ceramics, particularly nitrites and carbides, for extending the upper temperature limits of engineering systems of interest to DOD and NASA. Applications of particular interest are gas turbines for peaking electric power generation and for use as power sources in vehicles.

BUILDING RESEARCH ADVISORY BOARD

The Building Research Advisory Board (BRAB) undertakes activities concerned with the development and application of technology to serve societal needs for housing, building, and related community and environmental design and development. BRAB's activities are organized into International Technical Programs (ITP), National Technical Programs (NTP), and a Technology Assessment and Utilization (TAU) Program.

Four technical committees—Societal and Environmental Objectives, Human and Natural Resources, Building Process Functions, and Invention and Innovation—manage the ITP and NTP projects and coordinate these two program areas with TAU.

General Board activities include information services that are intended to ensure communication among the various elements of the Board, between the Board and the public and private sectors of the building community, and between the Board and the interested public. Included are four newsletters—*BRAB Building Research News, USNCCIB Building Research Notes,* the *FCC General Newsletter,* and the *FCC Energy Conservation Newsletter*—as well as a journal, *Building Research.* Proceedings of workshops and conferences, monographs, committee reports, and similar documents are also published.

The U.S. National Committee for the International Council for Building Research, Studies and Documentation (USNCCIB) effects U.S. participation in the activities of CIB, a nonprofit international organization of building-research-oriented public and private individuals and organizations, headquartered in Rotterdam and having status with the United Nations. The U.S. National Committee proposes to expand its participation in working commissions and steering groups of CIB through the organization of counterpart commissions in the United States and the selection of additional representatives in the international working groups.

The Federal Construction Council encourages cooperation among construction agencies of the federal government. The Council conducts ad hoc studies and continuing programs. Typical ad hoc studies completed during the year were: Use of Elevators During Fires, Steam Boiler and Hot Water Generator Criteria. The six continuing programs are: The Federal Construction Guide Specifications Program, the Cost Engineering Program, the Computer Technology Program, The Design Criteria Program, the Fire Safety Program, and the Information Exchange Program.

The Technology Assessment and Utilization Program Committee arranges exchanges of information with a broad spectrum of people, and is developing an annual Building Futures Forecast and Building Futures Forum. Seven multidisciplinary Resource Councils have been formed covering socioeconomics, kinetic energies, materials, production technologies, construction technologies, and management. These Councils are encouraged to develop a body of affiliates to extend the range of contacts with individuals who can make positive contributions to the objectives of BRAB.

CONFERENCE ON ELECTRICAL INSULATION AND DIELECTRIC PHENOMENA

The Conference encourages and provides for the participation of workers from diverse disciplines in a common effort to attain a better understanding of dielectric phenomena and electric insulation behavior. The Conference performs two primary functions: (a) the organization of an annual meeting for the presentation of technical papers and the exchange of information through free discussion (summaries of the papers are published in the "Annual Report of the Conference"), and (b) the annual publication of the *Digest of Literature on Dielectrics*. The 1976 annual conference will be held from October 17 to 21, 1976.

COMMITTEE ON EVALUATION OF SULFUR OXIDES CONTROL TECHNOLOGY

This project was undertaken in response to a request from the U.S. Environmental Protection Agency for a comprehensive assessment of the current status and future prospects of sulfur oxides control methods and strategies. It is anticipated that the study will also include estimates of economic impact and optimum rate of application of this technology. Foreign and U.S. control methods available or under development will be considered and evaluated to assess their applicability to various combustion and industrial processes that require control to meet applicable emission standards. The conclusions and recommendations that result from the study are expected to assist the legislative and executive agencies in making decisions to meet the national need for reduced sulfur oxides emissions arising from fossil-fuels utilization and from industrial process sources.

COMMITTEE ON FIRE RESEARCH

The interests of the Committee include fundamental research on the understanding of fire through the chemical, physical, and engineering sciences; applied research in the development of technologies for preventing and controlling fire; modern analytical methods, such as operations analysis, for the study of fire behavior and fire fighting; and the physiological, sociological, and behavioral aspects of persons involved with fires. Specific topics that may be considered by the Committee are fire prevention and fire safety in dwellings and public and industrial buildings; toxicology and physiology of combustion products; combustion studies; and fuel (energy) combustion studies.

The Committee publishes *Fire Research Abstracts and Reviews* and the *Directory of Fire Research*, conducts symposia on current topics in fire problems, and advises the National Bureau of Standards, the Defense Civil Preparedness Agency, the National Science Foundation, the Forest Service, and the National Fire Prevention and Control Administration on their fire problems.

COMMITTEE ON INTERNATIONAL DISASTER ASSISTANCE

This Committee, which is now being formed, will provide advice and assistance to the Administrator of the Agency for International Development and to the AID Office of the Foreign Disaster Relief Coordinator concerning (a) the U.S. role in international disaster assistance, (b) the identification of major problems toward which scientific and technical knowledge can be applied in the AID/FDRC international disaster assistance program, (c) an assessment of the state of the art in scientific and technical fields relating to disaster assistance, and (d) the identification of deficient areas of scientific and technical knowledge of disasters that need to be addressed in future research and development. Plans for this program are being closely coordinated with the Commission on International Relations and with other organizational units of the Academy whose interests and expertise relate to the subjects to be studied.

U.S. NATIONAL COMMITTEE FOR THE INTERNATIONAL INSTITUTE OF REFRIGERATION

The U.S. National Committee assists the National Research Council by effecting U.S. participation in the International Institute of Refrigeration (IIR) on behalf of scientists, engineers, and technologists interested in the application of low temperatures and research and development in the field of cryogenics. The Committee promotes the use of low-temperature technology and science in the United States, particularly in those areas that involve international cooperation. It nominates, for appointment by the President of the Academy, persons to serve on the U.S. National Committee and the official delegate [illegible] quadrennial International Congress of IIR.

COMMITTEE ON NATURAL DISASTERS

This Committee evolved from the Committee on Earthquake Inspection. Its mission was broadened in June 1971 to encompass earthquakes, winds, floods, tsunamis, and conflagrations. Teams are dispatched as soon as possible following a disaster to investigate episodes of engineering design and structural interest. The Committee is concerned with improving engineering to mitigate the effects of natural disasters and with encouraging research in natural disaster engineering.

The Committee's Wind Engineering Research Panel is preparing a report on the need for research in wind engineering to enable engineered structures to better withstand the effects of damaging winds. An Earthquake Engineering Research Panel is being formed to update and revise the 1969 report, *Earthquake Engineering Research.* Another panel is being established to recommend instrumentation networks for the collection of strong-motion data in the United States.

COMMITTEE ON PROCESSING AND UTILIZATION OF FOSSIL FUELS

This Committee was established to evaluate the current status of technology and the research and development priorities needed to provide for the more efficient use of domestic coal resources. Foreign and U.S. methods of coal extraction, processing, and utilization—available or under development—are being considered and evaluated relative to a variety of U.S. conditions and needs. Specifically, the Committee is to (a) assess the priorities to be assigned to the components of a process; (b) outline research and development needs; (c) identify supportive research requirements, with particular attention to the role of universities; (d) develop projected time schedules and development strategies; (e) assess environmental impact and related technology requirements; and (f) review the socioeconomic impact from these coal conversion processes with regard to materials, capital, and manpower requirements.

COMMITTEE ON SOCIOECONOMIC EFFECTS OF EARTHQUAKE PREDICTION

Under a grant from the National Science Foundation, the Committee will conduct an 18-month study to develop plans for future empirical field studies of actual earthquake predictions and of predicted earthquakes. The study objectives are to identify basic problems and hypotheses to be addressed by future research on the socioeconomic effects of earthquake predictions and warnings and on actions that might be taken to save lives, protect property, and minimize social disruption.

APPENDIX I

THE NATIONAL ACADEMY OF SCIENCES

ANNUAL MEETING, 1976

The One Hundred and Thirteenth Annual Meeting of the National Academy of Sciences was held in Washington, D.C., on April 26, 27, and 28, 1976. Three hundred and eighty-six members, one emeritus, and two foreign associates attended all or part of the meeting as follows:

Abelson, Philip H.
Adams, Robert McC.
Ahrens, Edward H., Jr.
Aigrain, Pierre R.[1]
Alberty, Robert A.
Anders, Edward
Anderson, Thomas F.
Andrews, Henry N., Jr.
Anfinsen, C. B.
Astin, Allen V.
Atkinson, Richard C.
Austen, K. Frank
Babcock, Horace W.
Bacher, Robert F.
Bainbridge, Kenneth T.
Baker, W. O.
Barschall, Henry H.
Beams, J. W.
Bearn, Alexander G.
Benacerraf, Baruj
Bender, Myron L.
Benditt, Earl P.
Bernstein, Richard B.
Bers, Lipman
Bigeleisen, Jacob
Bing, R. H.
Bisplinghoff, Raymond L.
Bloch, Herman S.
Bloembergen, Nicolaas
Blout, Elkan R.
Blumberg, Baruch S.
Boekelheide, V.
Bogorad, Lawrence
Bohr, Aage[1]
Bok, Bart J.
Bold, Harold C.
Boudart, Michel
Boulding, Kenneth E.
Bovey, Frank A.
Boyer, P. D.
Brady, Roscoe O.
Braidwood, Robert J.
Branscomb, Lewis M.
Brattain, Walter H.
Breslow, Ronald
Brewer, Leo
Briggs, Winslow R.
Brobeck, John R.
Brooks, Chandler McC.
Brooks, Harvey
Bruice, Thomas C.
Buchanan, John M.
Buchsbaum, S. J.
Bullock, Theodore H.
Burns, John J.
Burton, Glenn W.
Cairns, T. L.
Carter, H. E.
Case, Kenneth M.
Chamberlain, Joseph W.
Chance, Britton
Chanock, Robert M.
Chase, Merrill W.
Chodorow, Marvin
Christy, Robert F.
Clements, John A.
Closs, Gerhard L.
Cloud, Preston
Cockerham, C. Clark
Cohen, Melvin J.
Cohen, Morris
Cohen, Philip P.
Cohn, Zanvil A.
Cole, Kenneth S.
Colowick, Sidney P.
Comroe, Julius H., Jr.
Cooper, Leon N.
Cotton, F. Albert
Cotzias, George C.
Cowling, Ellis B.
Cox, Gertrude M.
Crane, H. Richard
Crawford, Bryce, Jr.
Creutz, E.
Cristol, Stanley J.
Crow, James F.
Dalldorf, G.
Dauben, William G.
Davis, Bernard D.
de Laguna, Frederica
Dicke, Robert H.
Dole, Vincent P.
Dorfman, Albert
Drake, F. D.
Drickamer, Harry G.
DuBridge, L. A.
Eagle, Harry
Ebert, James D.
Edelman, Gerald M.

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[1] Foreign Associate.

Edsall, John T.
Eliel, Ernest L.
Estes, William K.
Evans, Harold J.
Fawcett, Don W.
Federer, Herbert
Feenberg, Eugene
Fischer, Edmond H.
Flygare, W. H.
Forbush, Scott E.
Forster, Robert E.
Fraenkel, Gottfried S.
Frauenfelder, Hans
Fredrickson, Donald S.
French, C. Stacy
Friedlander, Gerhart
Friedman, Herbert
Friedmann, Herbert
Friedrichs, K. O.
Fultz, Dave
Furth, Jacob
Garner, Wendell R.
Garwin, Richard L.
Gates, Marshall
Giacconi, Riccardo
Giles, Norman H.
Ginzton, E. L.
Gleason, Andrew M.
Goddard, David R.
Gold, T.
Goldberg, Leo
Goldberger, M. L.
Goldhaber, Gertrude S.
Goldhaber, Maurice
Goldstine, Herman H.
Gomory, R. E.
Goodenough, Ward H.
Goody, Richard M.
Gordy, Walter
Gottschalk, Carl W.
Goudsmit, Samuel A.
Gould, Roy W.
Grad, Harold
Gray, Harry B.
Griffin, James B.
Griliches, Zvi
Grobstein, Clifford
Gross, Ludwik
Guillemin, Roger
Gunsalus, Irwin C.
Haagen-Smit, Arie J.
Hackerman, Norman
Haensel, Vladimir
Hahn, E. L.
Hammes, Gordon G.
Hammond, George S.
Handler, Philip
Hardy, James D.
Hartline, H. Keffer
Haskins, Caryl P.
Hasler, Arthur D.
Haurowitz, Felix
Haworth, Leland J.
Hedberg, Hollis D.
Hendricks, Sterling B.
Hepting, George H.
Herring, W. Conyers
Hertz, Roy
Hill, Robert L.
Hill, Terrell L.
Hirsch, James G.
Hollaender, Alexander
Horowitz, Norman H.
Horsfall, James G.
Horstmann, Dorothy M.
Hubbert, M. King
Hulse, Frederick S.
Hurvich, Leo M.
Hutchison, Clyde A., Jr.
Inghram, Mark G.
Isaacs, John D.
Jacobson, Leon O.
Jacobson, Nathan
Jameson, Dorothea
Jensen, Elwood V.
John, Fritz
Kabat, Elvin A.
Kamen, Martin D.
Kaplan, Henry
Kaplan, Nathan O.
Kates, Robert W.
Katz, Joseph J.
Kellermann, K. I.
Kety, Seymour S.
King, C. G.
Kompfner, Rudolf
Kramer, Paul J.
Langbein, Walter B.
Lawrence, H. Sherwood
Lax, Benjamin
Leaf, Alexander
Lehninger, A. L.
Leopold, Estella Bergere
Leopold, Luna B.
Lerner, Abba P.
Levine, Philip
Licklider, J. C. R.
London, Irving M.
Long, Franklin A.
Lorenz, Edward N.
Lowry, Oliver H.
Luce, R. Duncan
Luyten, Willem J.
Macdonald, J. Ross
Mac Lane, Saunders
MacNeish, Richard S.
Malone, Thomas F.
Margoliash, Emanuel
Margrave, John L.
Mark, H. F.
Marks, Paul A.
Mayer, Joseph E.
Mayr, Ernst
McCarty, Maclyn
McDermott, Walsh
McKusick, Victor A.
McLean, William B.
McShane, E. J.
Mead, Margaret
Melton, Arthur W.
Merrifield, Bruce
Merton, Robert K.
Mertz, Edwin T.
Meyer, Karl
Miller, Neal E.
Miller, Stanley L.
Minsky, Marvin
Morales, Manuel F.
Morgan, James N.
Mostow, G. D.
Mulliken, Robert S.
Munk, Walter H.
Myers, Jack
Nachmansohn, David
Neff, William D.
Neurath, Hans
Ney, Edward P.
Neyman, Jerzy
Nirenberg, Marshall Warren
Nolan, Thomas B.
Novikoff, Alex B.
Odum, Eugene P.
Oncley, J. L.
Ostriker, Jeremiah P.
Page, Irvine H.
Patel, C. Kumar N.
Patrick, Ruth
Patterson, Bryan
Pearson, Ralph G.
Penzias, Arno A.
Pettijohn, F. J.

Pierce, J. R.
Pimentel, George C.
Pines, David
Piore, E. R.
Pitzer, K. S.
Porter, Keith R.
Potter, Van R.
Press, Frank
Price, P. Buford
Quate, C. F.
Rabi, I. I.
Radner, Roy
Raper, Kenneth B.
Ratner, Sarah
Revelle, Roger
Rice, Oscar K.
Rich, Alexander
Richter, Curt P.
Ripley, S. Dillon
Roberts, John D.
Roberts, Richard B.
Rodgers, John
Rollins, Reed C.
Rossini, Frederick D.
Russell, Elizabeth S.
Russell, William L.
Sachs, Robert G.
Salisbury, G. W.
Salpeter, E. E.
Scharrer, Berta V.
Schmidt-Nielsen, Knut
Schmitt, Francis O.
Schneiderman, Howard A.
Schultz, Theodore W.
Scrimshaw, Nevin S.
Seaborg, Glenn T.
Segal, I. E.
Seitz, Frederick
Shapiro, Irwin I.
Sheehan, John C.
Shemin, David
Shull, Clifford G.
Shull, Harrison
Shulman, Robert G.
Silver, Leon Theodore
Simmons, H. E.
Simpson, John A.
Sinsheimer, Robert Louis
Slater, John C.
Slichter, Charles P.
Smith, Emil L.
Smyth, Charles P.
Snell, George D.
Sonneborn, T. M.
Spiegelman, Sol
Spitzer, Lyman, Jr.
Sprague, G. F.
Stadtman, E. R.
Steiner, Donald F.
Stellar, Eliot
Stetten, DeWitt, Jr.
Stever, H. Guyford
Stewart, T. D.
Stigler, George J.
Stockmayer, W. H.
Suess, Hans E.
Swift, Hewson
Tamm, Igor
Tarbell, D. Stanley
Tarski, Alfred
Taussig, Helen B.
Teuber, H. L.
Thimann, Kenneth V.
Thomas, L. H.
Tishler, Max
Tousey, Richard
Townes, Charles H.
Tukey, John W.
Underwood, Benton J.
Vallee, Bert L.
Van Vleck, J. H.
Wall, Frederick T.
Wasserburg, G. J.
Watson, Cecil James
Watson, Kenneth M.
Waugh, J. S.
Weber, Ernst
Weber, Gregorio
Wedel, Waldo R.
Weller, Thomas
Wetherill, George W.
Wheatley, John C.
Wheeler, John A.
Whinnery, John R.
White, Donald E.
White, Gilbert F.
White, Harrison C.
Whitehead, George W.
Whittaker, Robert H.
Wick, Gian-Carlo
Widom, Benjamin
Williams, Carroll M.
Wilson, E. Bright
Wintrobe, M. M.
Witkop, Bernhard
Woodring, Wendell P.[1]
Woolsey, Clinton N.
Wyngaarden, James B.
Yalow, Rosalyn S.
Yoder, Hatten S., Jr.
Zamecnik, Paul C.
Zwanzig, Robert
Zworykin, V. K.

BUSINESS SESSION

There being a quorum present, President Handler called the Academy to order in Business Session in the Auditorium of the Academy at 9:15 a.m.

President's Announcements

Tellers for Preference Ballot

The President announced the names of those who served as Tellers for the Preference Ballot and for the Ballot for election of a Treasurer and four councilors: Sterling B. Hendricks, Chairman; Allen V. Astin; and T. D. Stewart.

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[1] Member Emeritus

Section Chairmen

President Handler announced the names of newly elected Section Chairmen and explained that, to initiate the creation of the new Sections of Class II and IV as determined by votes of those classes, in accordance with Bylaw II.3, organizing chairmen had been appointed for each of the new Sections. The new chairmen were as follows:

Elected for three-year terms ending June 30, 1979

Applied Physical and Mathematical Sciences—T. H. Geballe, to succeed George F. Carrier.
Geology—Preson Cloud, to succeed Hatten S. Yoder.
Mathematics—A. M. Gleason, to succeed Nathan Jacobson.

Appointed for one-year terms ending June 30, 1977

Cellular and Developmental Biology—Harry Eagle.
Medical Genetics, Hematology and Oncology—Maxwell M. Wintrobe.
Infectious Diseases and Immunology—Robert M. Chanock.
Neurobiology—Theodore H. Bullock.
Physiological Sciences—Hermann Rahn.
Medical Physiology, Endocrinology and Metabolism—DeWitt Stetten, Jr.

The members stood for the reading of the names of fourteen members, seven foreign associates, and three members emeriti who had died since the 1975 Annual Meeting as follows:

Members Deceased Since Last Annual Meeting:

Jacob Bjerknes, born November 2, 1897; elected to the Academy in 1947; died July 7, 1975
Detlev Wulf Bronk, born August 13, 1897; elected to the Academy in 1939; died November 17, 1975
David Mathias Dennison, born April 26, 1900; elected to the Academy in 1953; died April 3, 1976
Theodosius Dobzhansky, born January 25, 1900; elected to the Academy in 1943; died December 19, 1975
Lester Reynold Dragstedt, born October 2, 1893; elected to the Academy in 1950; died July 16, 1975
John Ray Dunning, born September 24, 1907; elected to the Academy in 1948; died August 25, 1975
Percy Lavon Julian, born April 1, 1899; elected to the Academy in 1973; died April 19, 1975
Berwind Peterson Kaufman, born April 23, 1897; elected to the Academy in 1952; died September 12, 1975
Norman Levinson, born August 11, 1912; elected to the Academy in 1967; died October 10, 1975
Alfred Lee Loomis, born November 4, 1887; elected to the Academy in 1941; died August 11, 1975
Robert Franklin Mehl, born March 30, 1898; elected to the Academy in 1958; died January 29, 1976
Rudolph Lee Minkowski, born May 28, 1895; elected to the Academy in 1959; died January 4, 1976

Thomas Kilgore Sherwood, born July 25, 1903; elected to the Academy in 1958; died January 14, 1976

Edward Lawrie Tatum, born December 14, 1909; elected to the Academy in 1952; died November 5, 1975

Foreign Associates Deceased Since the 1975 Annual Meeting

Per Geijer, born July 7, 1886; elected to the Academy in 1958; died March 24, 1976

Ernst Hadorn, born May 31, 1902; elected to the Academy in 1969; died April 4, 1976

Werner Heisenberg, born December 5, 1901; elected to the Academy in 1961; died February 1, 1976

William Vallance Hodge, born June 17, 1903; elected to the Academy in 1959; died July 7, 1975

Wilder Penfield, born January 26, 1891; elected to the Academy in 1953; died April 5, 1976

Sir Geoffrey Taylor, born March 7, 1886; elected to the Academy in 1945; died June 27, 1975

Mogens Christian Wanning Westergaard, born June 12, 1912; elected to the Academy in 1972; died June 8, 1975

Members Emeriti Deceased Since Last Annual Meeting

Chester Ray Longwell, born October 15, 1887; elected to the Academy in 1935; died December 15, 1975

Charles William Metz, born February 17, 1889; elected to the Academy in 1948; died February 25, 1975

George Hoyt Whipple, born August 28, 1878; elected to the Academy in 1929; died February 1, 1976

Public Welfare Medalist Deceased Since Last Annual Meeting

Henry Allen Moe, awarded in 1958, born July 2, 1894; died October 2, 1975

Biographical Memoirs Assigned Since Last Annual Meeting

Abraham Adrian Albert by Irving Kaplansky
William Foxwell Albright by Gus Van Beek
Percival Bailey by Paul C. Bucy
Detlev Wulf Bronk by Frank Brink
Lester R. Dragstedt by Mr. & Mrs. Owen Wangensteen
Griffith Conrad Evans by Charles B. Morrey, Jr.
Berwind Petersen Kaufmann by Joseph Gall
Warren Kendall Lewis by Hoyt Clarke Hottel
Chester Ray Longwell by John Rodgers
Alfred Lee Loomis by Luis W. Alvarez
Maria Goeppert Mayer by Robert G. Sachs
Arnold Rice Rich by Ella Oppenheimer
David Rittenberg by David Shemin
Hermann Irving Schlesinger by H. C. Brown
Thomas Kilgore Sherwood by Hoyt Clarke Hottel

Biographical Memoirs Received Since Last Annual Meeting

Edgar Anderson by G. Ledyard Stebbins
Edgar Collins Bain by James B. Austin
Vannevar Bush by Jerome B. Wiesner

Rufus Cole by C. Phillip Miller
Lyman Creighton Craig by Stanford Moore
Leslie Clarence Dunn by Theodosuis Dobzhansky
Wallace Osgood Fenn by Herman Rahn
Edwin Richard Gilliland by Thomas K. Sherwood
William Zen Hassid by H. A. Barker and Clinton Ballou
Robert Frederick Loeb by Alexander Bearn
Samuel Kirkland Lothrop by Gordon R. Willey
Robert Raynolds McMath by O. C. Mohler and H. Dodson-Prince
Francis Peyton Rous by Renato Dulbecco
William Walden Rubey by W. G. Ernst
Joel Stebbins by A. E. Whitford
Earl Wilbur Sutherland, Jr., by Carl F. Cori
Ernest Edward Tyzzer by Thomas H. Weller
Carl John Wiggers by Eugene M. Landis
William Hammond Wright by Charles D. Shane

Actions in Response to Special Invitations to the Academy

Occasion of the 250th Anniversary of the USSR Academy of Sciences in Moscow, on October 6, 1975. George Hammond.

Inauguration of William Edward Lavery as President of the State University, Blacksburg, Virginia, on October 16, 1975. Dietrich H. Bodenstein.

Memorial Service for Edward L. Tatum at Rockefeller University, on December 11, 1975. David R. Goddard.

Memorial Service for Detlev W. Bronk at Rockefeller University, on February 18, 1976. Philip Handler.

Dedication of the Harold D. West Basic Medical Sciences Building, Meharry Medical School, Nashville, Tennessee, on February 26, 1976. Philip Handler.

Occasion of the Centenary Celebration of the American Chemical Society in New York City, on April 9, 1976. Philip Handler.

Occasion of the Bicentennial Symposium of the Academy of Natural Sciences, in Philadelphia, April 19–21, 1976. David R. Goddard.

Election of Treasurer and Four Councilors

The Home Secretary reported the results of the mail ballot for election of a Treasurer and four Councilors. He announced that E. R. Piore had been reelected Treasurer for a four-year term beginning July 1, 1976. Among the nominees for three-year terms on the Council, beginning July 1, 1976, the following two candidates received a majority of the votes cast and were declared elected: Frank H. Westheimer, A. L. Lehninger.

Ballots were distributed for the members to vote on the remaining candidates and resulted in the election of Philip W. Anderson and DeWitt Stetten, Jr., as the two additional members of the Council.

Election of Members

The newly elected members for 1976 are as follows: Robert Heinz Abeles, Robert Kemp Adair, Clarence Roderic Allen, Theodore Wilbur Anderson, John Norris Bahcall, Charles Palmer Bean, Ernest Beutler, Hubert Morse Blalock, Jr., John Robert Borchert, Raj Chandra Bose, John I. Brauman, Warren Lee Butler, Alastair G. W. Cameron, Julian David Cole, Harold Colyer Conklin, Ernest David Courant, Cassius Chapin Cutler, George Kelso Davis, Karl Wolfgang Deutsch, Russell Lee De Valois, Zacharias Dische, John Elliott Dowling, Edward Vaughn Evarts, Ugo Fano, Gary Felsenfeld, George McClelland Foster, Jr., Charlotte Friend, Harold Paul Furth, Stanley Marion Garn, Walter Gilbert, Harry Grundfest, Homer Dupre Hagstrum, Morris Howard Hansen, William Fields Harrington, Philip Morris Hauser, Wassily Hoeffding, David Swenson Hogness, John Robert Huizenga, Jerome Karle, Arthur Kelman, Hilary Koprowski, Saul Krugman, Alvin Meyer Liberman, Joaquin Mazdak Luttinger, Bruce Herbert Mahan, Arno Gunther Motulsky, Kenneth Gardiner McKay, Peter Carey Nowell, George Andrew Olah, Albert Warner Overhauser, George Edward Pake, Norman A. Phillips, George Polya, Hans Popper, John Randolph Preer, Jr., Frank William Putnam, Oscar Davis Ratnoff, Julia Robinson, Walter Alter Rosenblith, John Ross, Frank Hugh Ruddle, Herbert Eli Scarf, Robert Tod Schimke, Gerhard Schmidt, Jacob Theodore Schwartz, William Hamilton Sewell, Peter P. Sorokin, Franklin William Stahl, Richard Cawthon Starr, Harry Suhl, Richard Gordon Swan, David Wilson Talmadge, H. Edwin Umbarger, Richard N. Zare, E-an Zen.

Election of Foreign Associates

Lars V. Hörmander, Mathematics, Sweden; Michael Sela, Biochemistry, Israel; Gerardo Reichel-Dolmatoff, Anthropology, Colombia; Stein Rokkan, Social and Political Sciences, Norway; Sir Bernard Katz, Physiology, U.K.; Andrei Monin, Geophysics, U.S.S.R.; Harry Harris, Genetics, U.K.; Sir (Michael) James Lighthill, Applied Physical and Mathematical Sciences, U.K.; Res Jost, Physics, Switzerland; Ludwig Biermann, Astronomy, West Germany; Seiya Uyeda, Geology, Japan; Leo Esaki, Engineering, Japan; Martin Lindauer, Zoology, West Germany; Ralph O. Slatyer, Botany, Australia; Brenda Milner, Psychology, Canada.

Committees on Trust Funds and Medals

The following committees are scheduled to make awards or continue in their grant activities in 1977:

Carty Medal, for noteworthy and distinguished accomplishments in any field of science coming within the scope of the charter of the Academy.

NAS Award for Environmental Quality, for outstanding contributions based in science and technology to improve the quality of the environment or in the control of its pollution by man.

NAS Award in Applied Mathematics, for noteworthy contributions in this field.

U.S. Steel Award in Molecular Biology, for recent notable discovery in molecular biology by a young scientist.

Waksman Award in Microbiology, for distinguished contributions in this field.

Walcott Medal, to stimulate research in preCambrian or Cambrian life.

Merrill Fund, for studies of meteors, meteorites, and space.

V. M. Slipher Fund, for the general benefit of Astronomy . . . administered by the Section of Astronomy as the section deems fit, including the fostering of public education in Astronomy.

Bache Fund, to aid research in the physical and natural sciences.

Report of the Home Secretary

Membership

With the addition of 84 new members at the 1975 annual meeting the membership of the National Academy of Sciences reached 1133. Subsequent deaths and transfers to emeritus status have reduced the membership to 1115, as of April 19, 1976. In addition, there are currently 29 emeritus members and 142 foreign associates. Since the last annual meeting, five members requested transfer to emeritus status and were so recorded on the rolls of the Academy. The Academy has lost by death 14 members, three members emeriti, and five foreign associates. We lost by death the senior emeritus member, George Hoyt Whipple, who was born in 1878. Joel H. Hildebrand, born in 1881, is our oldest active member.

The membership of the Academy, distributed by Class, as shown in the records of the Home Secretary's office, is as follows:

Class I	Physical and Mathematical Sciences	452
Class II	Biological Sciences	305
Class III	Engineering and Applied Sciences	155
Class IV	Medical Sciences	84
Class V	Behavioral and Social Sciences	119

Preference Ballot

At their meetings on February 7, 1976, the Class Membership Committees considered the names of nominees and placed 105 on the Preference Ballot. Classes I and III each excluded one name assigned to them. Class II listed three less than the rules allowed (150% of the Class Quota) and Class V was two lower than the quota allowed. In addition to the usual nominations from the sections, there were on the Preference Ballot five Intersectional Nominations, 12 nominations from Voluntary Nominating Groups and 10 nominations from Temporary Nominating Groups as follows: TNG in Geography, three; TNG in Planetary Sciences, one; and TNG in Statistics, six.

Mechanisms of Election to the Academy

The mechanisms of election to the NAS are complex and irritating to quite a few members. I have proposed no changes, since I wished experience with the current rules. It is my intention to recommend to the Council that a study of election procedures be initiated.

Biographical Memoirs

Volume 47 has appeared in print and Volume 48 is in the process of publication. Volume 48 is scheduled for distribution this summer. We have manuscripts on hand for Volume 49 and have received some for placement in Volume 50.

Bylaw Committee

The Council has established a Bylaw Committee chaired by the Home Secretary. Its recommendations with minor revisions by the Council are on the Business Meeting Agenda.

Report of the Foreign Secretary

The substance of the report of the Foreign Secretary may be found under "International Activities" on page 47.

Report of the Treasurer

E. R. Piore, Treasurer of the Academy, began his report by expressing gratitude for the confidence expressed by the membership in his reelection to this position. He reported briefly on the management of the endowment fund and stated that details of the Academy's finances were included in documents previously mailed to the membership including the Treasurer's Report for Fiscal Year 1975 and the first half of 1976. Mr. Piore announced that, after considerable deliberation and consultation, the Finance Committee had decided to transfer management of the endowment fund from Morgan Guaranty Trust Company to two different investment firms, each to manage, independent of the other, approximately one-half of the endowment. The two firms selected were American Security and Trust Company of Washington, D.C., and Weiss, Peck and Greer of New York City. He explained that this was undertaken as an experiment which would be carefully monitored. Mr. Piore also referred briefly to the budget of the NRC for the current fiscal year and projected budget for FY 1977. He concluded his report by announcing that negotiations to purchase the Houston House property in Woods Hole, Massachusetts, were virtually completed. The Treasurer's Report may be found in full on page 409 of the Annual Report.

Report of the Vice President

The report of the Vice President traditionally is about the work of a committee which he chairs: the Report Review Committee (RRC). In the past this report has been delivered first in person and then reduced to writing. This year the new Home Secretary had the excellent idea that this report (and others) should be available in advance to the members of the Academy—so we had a sudden request for an early text of the report. As it happened, this request came at a time when the full resources of the Report Review Committee were strained to capacity by many different tasks: One was up in the air: We were recommending the inclusion of the necessary caveats about the accuracy of mathematical models of the atmosphere, as presented in a report on photochemical oxidants. In other reports, there were complications brought about by a leak of ozone from the stratosphere, a troublesome question about the proposed large space telescope and the quality of "seeing" which it would provide, plus a considerable uncertainty about the possible transfer of technologies resulting from foreign ownership of some U.S. electronics companies. In addition, natural hazards (as so often!) were proving hard to control; a very timely report about the Guatemala earthquake pointed out that some buildings in Guatemala City suffered extensive structural damage because they were poorly constructed, but did not bring out clear enough evidence of the reasons for the poor construction, while a report on "Project Stormfury" involved the touchy question: If a hurricane is seeded, does it really diminish the force of the storm, or might it perhaps even increase the destructive effects when the storm hits land? This question also had diplomatic overtones because there is some hope to test this seeding in the western Pacific where the land which could be damaged might not be ours. This was actually not the only current report with diplomatic overtones; for example, there was one about how to negotiate in the forthcoming Conference on the Law of the Sea, so as to assure the continuation of scientific research in the oceans. Here, as always, the RRC had to recommend steps to achieve greater clarity. As for classified reports, there were none that came to us for review this year.

Report of the President

The Report of the President may be found in the beginning of the Annual Report.

Amendments to Constitution

Referring to Article VII of the Constitution, the Home Secretary stated that the proposed constitutional amendments provisionally adopted by the Business Session in 1975 were being presented to this Business Session for final vote. Mr. Goddard explained that the changes involved specifying that the officers must be chosen from among the membership; giving officers and the Council the right to delegate some of their authority and formally recognizing the National Academy of Engineering and the Institute of Medicine in the constitution of the National Academy of Sciences. Mr. Goddard also pointed out that copies of these amendments previously had been mailed to members and were distributed with the agenda for the meeting. The membership unanimously voted to approve the constitutional amendments.

Amendments Relating to Officers and Organization

1. ELIGIBILITY FOR OFFICE

Provide that all officers shall be chosen from the membership of the Academy.

Article II, Section 1—Amend the Section by adding the following language at the end of the sentence in the first paragraph: *"to be chosen from the membership."*

2. AUTHORITIES OF THE PRESIDENT AND COUNCIL

Certain procedures stated in the Constitution and Bylaws are no longer consistent with current practices that are followed in carrying out the affairs of the Academy and the National Research Council. These proposed amendments are to clarify authorities of the President and the Council with respect to the disposition of requests from the Government and the approval of contracts.

(Deleted sections are enclosed in brackets; new wording is in italics.)

a. Article II, Section 6—Amend the Section to read as follows:

"SECTION 6. The president of the Academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the Academy, *and* of the Academy Council, [and of the executive board of the National Research Council;] *shall, with the Academy Council, direct the general business of the Academy*; shall name all committees except such as are otherwise especially provided for; *and* shall, *as* authorized by the Council, refer *all* investigations [required] *requested* by the Government of the United States to members or other persons especially conversant with the subjects. [, and report thereon to the Academy at its meeting next ensuing and, with the Council, shall direct the general business of the Academy.] *In the event of the need for expeditious action, the president may act on requests by the Government of the United States and report his actions to the Council at its next meeting.*

The president shall serve as chairman of the National Research Council and of its Governing Board, except that in case of his prolonged absence or inability to act, the Academy Council shall designate the vice president as the acting chairman."

b. Article V. Section 3—Amend the Section to read as follows:

SECTION 3. Propositions for investigations or reports by the Academy shall be submitted to the Council for approval, [except these requested by the Government of the United States which] *after which they* shall be acted on by the president, who will [in such cases] report their results to the *sponsoring body."* [Government as soon as obtained.]

3. MODIFICATIONS FOR CONSISTENCY

A constitutional amendment is proposed to reflect action proposed in item 2 above merging the position of chief executive officer of the National Research Council with the position of President of the National Academy of Sciences.

Article II, Sections 2, 3, and 5—Delete the phrase, "the chief executive officer of the National Research Council (provided he be a member of the Academy)", wherever it appears in Sections 2, 3, and 5 of Article II.

4. FORMAL RECOGNITION OF NAE AND IOM

In approving the participating of NAE in the joint governance of NRC, it was stated that a continuous relationship between the two Academies would be formally recognized by appropriate amendment to the NAS Constitution which would give specific status to NAE. The same posture also should be made applicable to the NAS/IOM relationship. The proposed constitutional amendment would, as is now done with respect to NRC, provide for recognition of the National Academy of Engineering and the Institute of Medicine in the Constitution of the National Academy of Sciences.

Article II, Section 9—Renumber Section 9 as Section 11 and insert a new Section 9 and 10 as follows:

"NATIONAL ACADEMY OF ENGINEERING

Section 9. The National Academy of Engineering is established as a separate membership organization of the National Academy of Sciences, under Articles of Organization adopted by the Council of the National Academy of Sciences."

"INSTITUTE OF MEDICINE

Section 10. The Institute of Medicine is established as a separate membership organization of the National Academy of Sciences under terms of a charter adopted by the Council of the National Academy of Sciences."

5. PERPETUATION OF THE NATIONAL RESEARCH COUNCIL

Modification is to update reference to Executive Order of 1956 concerning NRC and to revise language to reflect that the action taken by the President of the United States was in the form of a request to NAS to continue the NRC.

Article II, Section 9—Renumber as Section 11 and amend as follows:

"*Section 11.* Pursuant to **[**the Executive Order issued**]** requests by the President of the United States *in 1918 and 1956* **[**May 11, 1918, and with the duties therein specified**]** the Academy shall perpetuate the National Research Council."

Amendment Relating to Delegation of Authority

6. DELEGATION OF AUTHORITY

To carry out the plan for governance of NRC, approved by the Academy, it is necessary to provide authority for the Council, the President, and other officers of the National Academy of Sciences to delegate certain authorities for which officials of the National Research Council (i.e. the Governing

Board) will be held accountable. These permissible delegations would not extend to authorities that relate to membership matters.

Article VII—Renumber Article VII to become Article VIII and add a new Article VII as follows:

> *"Article VII. Of Delegations of Authority*
>
> *Section 1. The Council, the president, and other officers may delegate their several authorities to appropriate officials of the National Academy of Sciences or the National Research Council except with respect to those authorities concerning membership affairs."*

Amendments to Bylaws

Mr. Goddard referred to the proposed amendments to the Bylaws which previously had been mailed to the members and were distributed with the agenda for the meeting. It was agreed that each proposed amendment should be voted upon separately and the Home Secretary presented them as follows:

1. Removal of Officers

Mr. Goddard explained that the Bylaws Committee offered this amendment as a safeguard against the possibility of inability to perform the duties of office due to either physical or psychological causes and that the Council modified the proposal to clarify the reference to "Councilors" as being non-officer members of the Council.

Mr. Jerzy Neyman spoke against the amendment and several other members spoke in favor. With Mr. Neyman being recorded as voting no, the membership VOTED to approve the following amendment to the Bylaws:

> Bylaw IV.7: Removal of Officers: "[The twelve Councilors may, by a two-thirds vote, suspend] *By a vote of 8 or more of the Councilors,* any officer *may be suspended* from his position on the grounds of malfeasance [in], *nonfeasance, or inability to perform the duties of the* office. A complete explanation for such action by the Councilors, together with a statement which may be volunteered by the suspended officer, will promptly be submitted to the membership, together with a mail ballot for ratification. If two-thirds of the members voting support the action of the Councilors, that officer will have been removed from office and the Council shall arrange for a special election to fill that position."

2. Composition of the Council

Mr. Goddard explained that this amendment was proposed to provide for representation of all Classes on the Council and presented it to the membership for vote. The membership unanimously VOTED to approve the following amendment:

> Bylaw IV.3: Nominations of Officers (Other than President) and Council Members, para. 2:
>
> "The nominating committee shall see that the slate of nominees for positions on the Council to fall vacant shall include not fewer than twice as many nominees as there are positions to be filled and that the geographic distribution and scientific

interests of the Academy are broadly represented on the slate. *If, for two consecutive years, the Council does not include a member of a given class, then, in the next annual election, the Home Secretary shall establish a separate slate of Council members for election from that Class to one of the four memberships on the Council becoming vacant. The nominating committee shall assure that not fewer than two candidates from the class shall appear on this separate slate.* The nominating committee shall report its slate of nominees to the Council prior to the submission by the nominating committee of such slate to the home secretary for preparation of a ballot."

3. *Election of Councilors*

Noting that this amendment was designed to provide for election of Councilors by plurality rather than majority vote, the Home Secretary further proposed a clarifying change in the final sentence in order to ensure that only meaningful ties are acted upon. Messrs. Ward Goodenough and Roy Radner both pointed out the advantages of requiring a majority of the votes and cited the fact that this had resulted in two Councilors being elected by the members present at this Business Session. Mr. Allen V. Astin, a member of the Bylaws Committee which proposed the amendment, spoke in favor of the amendment, explaining that the principal reason was to prevent a minority of the members from overruling the preference of the majority. He pointed out that over 80 percent of the membership usually responded to a mail ballot whereas attendance at a membership meeting is less than 30 per cent. Mr. Richard Garwin also spoke in favor of the amendment, agreeing with the reasons stated by Mr. Astin. After clarifying the language regarding a tie vote (changes shown in italics) the following amendment was adopted on a vote which was not unanimous:

Bylaw IV.3: Nominations of Officers (Other than President) and Council Members, para. 6:

"With respect to the election of members of the Council, the Council shall declare as elected the four candidates receiving the highest number of votes among those [receiving a majority of the] ballots cast. [If fewer than four candidates are so elected, an additional ballot of the members present and voting at the annual meeting shall be held to elect the remaining Council members. The number of candidates on the slate shall be at least twice the number of remaining vacancies and the candidates on that slate shall be selected from the remaining candidates on the first ballot in order of number of votes received.] A tie vote *affecting the election of the* [four] *councilors* shall be resolved by an additional ballot *at* [a] *the next business meeting of the Academy.*"

4. *Role of Foreign Associates*

Because of an increasing number of inquiries concerning the participation of foreign associates in the nomination of Academy members, the Home Secretary presented a proposal which would clarify ambiguity in the matter. The membership unanimously VOTED to adopt the Bylaw as follows:

Bylaw I: Of Members: "Members emeriti and foreign associates shall have the privilege of participating in the meetings and of reading and communicating papers and shall be entitled to a copy of the publications of the Academy, but shall not be subject to its assessments. *They shall not vote, nor sign instruments of election of members or officers of the Academy.*"

Mr. Goddard explained that, in proposing this amendment, the Council reaffirmed the desire for Foreign Associates to participate in Academy activities and suggested that the Home Secretary write the section chairmen making it clear that the sections are free to receive advice from Foreign Associates concerning American candidates for membership, as well as Foreign Associates.

5. *Conformity of Language*

The following change in language was presented and unanimously approved:

Bylaw III.5: Deaths: "At each meeting the president shall announce the death of any member since the preceding meeting. As soon as practicable thereafter, the home secretary shall designate a member to write, or to secure from other source approved by the home secretary, a biographical [notice] *memoir* of each deceased member."

6. *Schedule for Election of Members*

The Home Secretary presented two amendments designed to alleviate problems encountered by the Office of the Home Secretary in securing appropriate election information in adequate time for presentation to the membership. Following an explanation of the changes, the membership unanimously VOTED to approve the amendments as follows:

Bylaw IV.14: Nomination Ballots: "The chairman of each section of the Academy shall submit to the members of his section, not later than [November 1] *October 25* of each year, an informal ballot containing in alphabetical order and without indications of rank on ballots of the previous year, the names of all persons remaining on the list or added thereto in accordance with the provisions above defined."

Bylaw IV.14: Nomination Ballots: "The chairman shall then certify to the home secretary, prior to [January 1] *December 15,* the names of all persons who have been voted for on the formal ballots, together with a statement of the number of votes each candidate received and of the number of members voting."

Reports on Trust and Endowment Funds

Alexander Dallas Bache Fund

The Bache Fund Committee recommended that the following grants be awarded:

No. 541. To Mr. Jeffrey W. Lang of the University of Minnesota, for studies of the courtship behavior of the American crocodile------ $500.00

No. 542. To Dr. Richard E. Pieper of the University of Southern California, for studies of seaweeds of the Pacific Coast of Guatemala-- $1035.00

Donald R. Griffin, *Chairman.*

Arthur L. Day Bequest

The Arthur L. Day Fund has as its objective the advancement of studies of physics of the earth. By the award at intervals of the A. L. Day Prize and

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Lectureship, it seeks to build a collection of published lectures on important aspects of geophysical research. The first A. L. Day Prize and Lectureship awarded to Hatten S. Yoder of the Carnegie Institution of Washington in 1972 is in the process of publication. The lectures were presented at Dartmouth College in 1975.

The Day Fund Grant Program undertakes the encouragement of U.S. researchers in their collaboration with foreign colleagues in geophysics by making grants to U.S. citizens to assist their joint efforts with foreign workers. These grants are made especially for field or laboratory work of mutual interest for which funds from other sources are very limited or nonexistent.

Grants since the last report have been made to the following recipients:

No. 30. Alan H. Shapley, Director of the National Geophysical & Solar-Terrestrial Data Center, Boulder, Colorado, to study the bottom, topside and the satellite measurements of the ionosphere and the coupling between the magnetosphere and the ionosphere with a special emphasis on low latitudes; in conjunction with R. G. Rastogi, Physical Research Laboratory, Navrangpura, Ahmadabad-------------------------------- $20,000

No. 31. Professor Melvin Calvin, Space Sciences Laboratory, University of California, Berkeley, for a joint organic geochemical study on the Algal Mats at Laguna Mormona, Baja, California------------------- $8,000

No. 32. Dr. John H. Reyonlds, Department of Physics, University of California, Berkeley, for travel and living expenses in Portugal while doing a study on "Potassium-Argon Dating in Portugal" in collaboration with Professor Martim Portugal Ferreira, director of the geochronology Laboratory in Coimbra, Portugal----------------------------------- $1,200

No. 33. L. T. Aldrich, I. S. Sacks and A. T. Linde, of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, for seismic studies in the active region of Central Peru, in conjunction with L. Ocola, Institute of Geophysics, Peru----------------------------- $25,000

No. 34. William A. Prothero, Institute of Geophysics and Planetary Sciences, University of California, San Diego, for a study of surface wave dispersion in Mexico, in conjunction with Alfonso Reyes of Centro de Investigacion Cientifica y Education Superior de Ensenada, B.C.----$20,722

No. 35. Harold C. Fritts, Laboratory of Tree Ring Research, University of Arizona, for tree ring research study and the reconstruction of past climate, between research workers in the United States and Switzerland----$3,500

GEORGE E. BACKUS, *Chairman.*

Daniel Giraud Elliot Medal

The Daniel Giraud Elliot Medal Selection Committee was asked on 14 November, 1975, to submit a nomination for the Elliot Medal for 1976, no later than 14 December, 1975. A preliminary ballot of 15 names was circulated by mail that resulted in a reduction to 4 names. From this short list, after consultation by mail, telegram, and telephone, the committee agreed to nominate Howard Ensign Evans, Colorado State University, and the nomination was sent to the Home Secretary on 10 December, 1975.

JOHN W. WELLS, *Chairman.*

Joseph Henry—Marsh Funds

At its meeting on June 22nd, 1975, the NAS Council agreed to establish a single committee to develop grants from the combined Joseph Henry and the Marsh Funds, since the former was "established to assist meritorious investigators, especially in the direction of original research," and the latter was "established to promote original research in the natural sciences." The income from the trust funds will allow the Academy to make somewhat more substantial grants to support worthy original research projects.

The 1976 Henry-Marsh Fund Committee feels that better use could be made of the limited funds available, if specific guidelines were established as to how grants are to be awarded. One consideration is that preference be given to young investigators, just getting started, rather than those who are well established. Proposals from graduate students should include a letter from their thesis professor. It is possible that a limit will be placed on the amount of the award.

After its initial work and taking action on the first two proposals presented, the Committee decided to simplify procedures by reviewing proposals once a year. In future, those received before March 1 will be reviewed during the month of March and recommendations made shortly after April 1. It is hoped that the establishment of these guidelines and wider publicity concerning the funds will result in an increase in number and quality of proposals received.

This year the Henry-Marsh Fund Committee has recommended that grants be made to the following individuals:

Ethan R. Nadel, John B. Pierce Foundation Laboratory, New Haven	$1,000
M. J. Lechowicz, University of Wisconsin, Madison	$ 700
Tim Clark, Idaho State University, Pocatello (for 1 year rather than the 2 years proposed)	$2,000
Kathleen Munthe, University of California, Berkeley	$1,176

Another proposal is currently undergoing review by the Committee.

JOHN BARDEEN, *Chairman.*

Jesse Stevenson Kovalenko Medal

In the past year the committee has been concerned with choosing a candidate for the 1976 Kovalenko Medal. After considering a number of individuals, the committee unanimously recommended Dr. Julius Comroe for the Medal. Dr. Comroe is cited for his accomplishments in cardiovascular and pulmonary physiology, and for his leadership of the Cardiovascular Research Institute at the University of California.

IRVINE H. PAGE, *Chairman.*

National Academy of Sciences Award for Environmental Quality

This award "for outstanding contributions based in science or technology to improve the quality of the environment or the control of its pollution by man" carries an honorarium of $5,000.00. Committee members worked actively to generate names for the award, and discussed these by correspondence and by telephone. The Committee recommendation for 1976 was that the award should be given to David M. Evans and the Academy Council has approved this recommendation. Presentation will be made at the Award Ceremony on the evening of April 26, 1976.

FRANKLIN A. LONG, *Chairman.*

V. M. Slipher Fund

The V. M. Slipher Fund augmented the American Astronomical Society's Visiting Professor Program this year by transferring $8500 to the program and thereby supporting 20 to 30 visiting professorships, six of which could not have otherwise been considered. The overall program is funded by the V. M. Slipher Fund, the Harlow Shapley Fund, and a grant from the Research Foundation.

GEORGE O. ABELL, *Chairman.*

Selman A. Waksman Prize

The Selection Committee recommended that the Selman Waksman Prize in Microbiology for 1976 be awarded to Wallace P. Rowe for his fundamental contributions to our understanding of the biology of animal viruses. Included among the notable contributions made by Rowe and his associates are the discovery of the adenoviruses; discovery that halogenated pyrimidines activate endogenous murine leukemia viruses (this provided the definitive evidence for the ubiquity in normal mouse cells of the genomes for these viruses); development of the assay for enumeration of murine leukemia viruses; demonstration that infection of AKR mice by their endogenous murine leukemia viruses is governed by two genetic loci, corresponding to chromosomally integrated viral genes.

HERMAN N. EISEN, *Chairman.*

G. K. Warren Prize

The committee for the G. K. Warren Prize operated by correspondence and after a brief exchange of letters arrived at the unanimous choice of Walter Langbein as their candidate for the 1976 award. Many names carried over from the time of the last award in 1973 and other newly proposed names were considered, but the Committee very promptly reached the conclusion that Walter Langbein's career most precisely epitomized the purposes for which the award has been created. The Committee's unanimous recommendation of Dr. Langbein as their candidate was transmitted to the Home Secretary of the Academy in the Committee Chairman's letter of January 24, 1976. The names of other candidates considered are preserved in the Committee's records for use by future committees.

HOLLIS D. HEDBERG, *Chairman.*

Report on the Proceedings

The *Proceedings* published 1,100 papers in 1975, substantially the same number (1,094) as in 1974. Manuscripts were received from over 400 members and foreign associates, not quite one-third of the eligible sponsors.

Beginning with the July, 1975, issue, papers have been grouped in the *Proceedings* in accord with their designated subject classification, to make it easier for readers to locate articles in particular fields of interest. The great majority of papers (approximately 90 percent) continue to be in the biological and medical sciences. The physical sciences and mathematics provide nearly 10 percent of the papers; the newer sections of the Academy as yet make little use of the *Proceedings*.

A transition to "photon" printing, beginning with the July, 1975, issue, caused severe production problems at the printer, resulting in delayed publication for four issues. The normal publication schedule has been achieved since November, 1975, thanks to considerable effort by the Editorial Office and the cooperation of the printer.

The substantial deficit incurred by the *Proceedings* in 1974 was reduced but not eliminated in 1975. The measures already taken for 1976 (changes in subscription rate and page charges, modification of the membership allowance policy, economies in editing and printing practices) are expected to provide adequate income in 1976 and 1977.

The Board of Editors continues to be concerned with the quality of some manuscripts which occasionally appear in the *Proceedings* and with the limited spectrum of the Academy membership which finds the *Proceedings* to be a useful medium of publication. The *Proceedings* was originally established to represent the best of American science, in all disciplines. The Board would welcome any suggestions as to ways in which the *Proceedings* could serve the membership of the Academy and fulfill its initial purpose.

ROBERT L. SINSHEIMER,
Chairman, Board of Editors.

SUNDAY EVENING CONCERT

On Sunday evening, April 25, Emanuel Ax gave a piano concert as a tribute to Detlev W. Bronk, former Academy president, who died November 17, 1975.

PRESENTATION OF AWARDS

On Monday evening, April 26, the National Academy of Sciences honored eleven scientists and one staff member for outstanding achievements in their respective fields during an award ceremony which took place in the Academy auditorium following a reception and buffet in honor of the award recipients in the Great Hall.

AWARD RECIPIENTS

The J. Lawrence Smith Medal and a $2,000 honorarium were awarded to John Armstead Wood of the Smithsonian Astrophysical Observatory, Cambridge, Massachusetts, for "his highly influential works over the past decade on the structure, classification, and evolution of meteorite bodies."

The Agassiz Medal was presented to Walter Heinrich Munk of the Institute of Geophysics and Planetary Physics, University of California, San Diego, "for outstanding experimental and theoretical research on the spectrum of motion in the oceans and the earth."

The National Academy of Sciences Public Welfare Medal was presented to Emilio Q. Daddario, Director of the Office of Technology Assessment, Washington, D.C., for his "sustained contributions to science and the national welfare" during the years he served as a Congressman.

The Daniel Giraud Elliot Medal and a $1,000 honorarium, were awarded to Howard Ensign Evans, Professor of Entomology, Colorado State University, for the work he has done over a 25-year span on the biology and evolution of behavior in wasps.

The Mary Clark Thompson Medal and a $1,000 honorarium were awarded to James Morton Schopf of the Coal Geology Laboratory, Ohio State University, for his "remarkable high level of scientific and scholarly work in both systematic paleontology and stratigraphy."

The Jessie Stevenson Kovalenko Medal and a $2,000 honorarium were awarded to Julius Hiram Comroe, Jr., Director of the Cardiovascular Research Institute and Professor of Physiology, University of California Medical Center, San Francisco, for contributing "immeasurably to the diagnosis and treatment of human disease" during his career which was devoted to the physiology and chemistry of respiration and the mechanical and chemical properties of the human lung.

The U.S. Steel Foundation Award in Molecular Biology and a $5,000 honorarium were awarded to Daniel Nathans, Director, Department of Microbiology, The Johns Hopkins University School of Medicine, "for his innovative use of molecular and cell biological tools to analyze the genome of an oncogenic virus."

The Gibbs Brothers Medal and a $1,000 honorarium were presented to John Charles Niedermair, formerly of the Bureau of Ships, U.S. Department of Navy, for "his guidance of the basic designs of all types of naval ships for the U.S. Navy."

The Selman A. Waksman Award in Microbiology and a $5,000 honorarium were presented to Wallace Prescott Rowe, Chief, Laboratory of Viral Diseases, Washington, D.C., "for fundamental contributions to our understanding of the biology of oncogenic viruses."

The G. K. Warren Prize and a $1,000 honorarium were presented to Walter B. Langbein, Senior Research Hydrologist, U.S. Geological Survey, Reston, Virginia, "for the significant advancement of hydrology and fluviatile geology through geophysics and mathematics."

The National Academy of Sciences Award for Environmental Quality and a $5,000 honorarium were awarded to David M. Evans, Consulting Engineering Geologist, Denver, Colorado, "for his key discovery that injection of liquids deep underground can generate earthquakes and for his subsequent studies and their environmental implications."

The National Academy of Sciences Award for Distinguished Service and a $2,000 honorarium were presented to Charles K. Reed, Executive Director, Assembly of Mathematical and Physical Sciences, National Research Council, for his exceptional achievement as a member of the professional staff of the National Academy of Sciences' National Research Council.

Following the Award Ceremony, those members who had been elected in 1975 were presented to the membership to the applause of their fellow members. They signed the members' book and were greeted by President Handler.

ACADEMY DINNER

On Tuesday, April 27, the annual Academy dinner for members and guests was held at the Statler Hilton Hotel.

SCIENTIFIC PROGRAM

The scientific sessions, all of which were open to the public, were held in the Academy's auditorium beginning on Monday, April 26, and continuing until Wednesday afternoon, April 28, as follows:

Monday, April 26

WHITHER SCIENCE IN THE NEXT DECADE?

A Symposium, Part I

GLENN SEABORG, *Chairman*
Professor of Chemistry
University of California, Berkeley

JOHN A. WHEELER, Joseph Henry Professor of Physics, Princeton University, Princeton, New Jersey: *A Few Faces of the Future of Physics.*

JEREMIAH P. OSTRIKER, Professor of Astrophysics Science, Princeton University Observatory, Princeton, New Jersey: *Galaxies: Changed Conceptions and Cosmological Consequences.*

FRANK PRESS, Chairman, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts: *Geophysics in the Decade after Plate Tectonics.*

Tuesday, April 27

WHITHER SCIENCE IN THE NEXT DECADE?

A Symposium, Part II

ELIOT STELLAR, *Chairman*
Provost and Professor of Physiological Psychology
University of Pennsylvania

SYDNEY BRENNER, Scientific Staff, Medical Research Council, Laboratory of Molecular Biology, Cambridge, England: *Biological Complexity.*

GERALD M. EDELMAN, Professor, Rockefeller University, New York, New York: *Cell Recognition—The Recent Excitement in Immunology and Developmental Biology.*

E. BRIGHT WILSON, Theodore William Richards Professor of Chemistry, Harvard University, Cambridge, Massachusetts: *The Role of Molecular Structure in Chemistry.*

Wednesday, April 28

MATERIALS AND THE DEVELOPMENT OF NATIONS:

The Role of Technology

(In conjunction with the National Academy of Engineering)

Welcoming Remarks—

PHILIP HANDLER, President, National Academy of Sciences.

COURTLAND D. PERKINS, President, National Academy of Engineering.

Keynote Address—

LORD RITCHIE-CALDER, Author and University Professor, Edinburgh, Scotland.

Exposition of Different Nations' Perceptions of Materials Supply and Demand Problems (near- and long-term) and Related Issues.

Invited Speakers—

VALENTIN HERNANDEZ ACOSTA, Minister of Mines and Hydro-Carbons, Caracas, Venezuela.

GEORGE C. KAHAMA, Director General, Capital Development Authority, Dodoma, Tanzania.

STUART HARRIS, Professor of Resource Economics, Centre for Resource & Environmental Studies, The Australian National University, Canberra, Australia.

CHARLES W. ROBINSON, Under Secretary of State for Economic Affairs, United States Department of State, Washington, D.C., U.S.A.

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Edward N. Cole, Chairman of the Board, International Husky, Inc., Bloomfield Hills, Michigan: *Selecting Appropriate Technologies for Varying National Economies.*

Jermen Gvishiani, Deputy Chairman, State Committee of Ministers Science & Technology, Moscow, U.S.S.R.: *Utilization of New Technology in a Planned Economy.*

Klaus-Heinrich Standke, Director, Office of Science and Technology, for United Nations, New York, New York: *Utilization of New Technology in Developing Countries.*

(Concurrent Workshops on the State of Relevant Technologies)

ACT OF INCORPORATION

AN ACT TO incorporate the National Academy of Sciences

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. B. Barnard,[1] at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden,[2] Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren,[2] United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Englemann, Saint Louis, Missouri; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Giless,[3] United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennyslvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, Junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the National Academy of Sciences.

SEC. 2. *And be it further enacted,* That the National Academy of Sciences shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, bylaws, and rules and regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. *And be it further enacted,* That the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated, and the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States.

GALUSHA A. GROW,
Speaker of the House of Representatives.
SOLOMON FOOT,
President of the Senate pro tempore.

Approved, March 3, 1863.
ABRAHAM LINCOLN, *President.*

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[1] The correct name of this charter member was F. A. P. Barnard.
[2] Declined.
[3] The correct name of this charter member was J. M. Gilliss.

AMENDMENTS

AN ACT To amend the act to incorporate the National Academy of Sciences

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the National Academy of Sciences approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said Academy as provided in said act.

Approved, July 14, 1870.

AN ACT To authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said Academy in aid of scientific investigation and according to the will of the donors.

Approved, June 20, 1884.

AN ACT To amend the act authorizing the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to authorize the National Academy of Sciences to receive and hold trust funds for the promotion of science, and for other purposes, approved June twentieth, eighteen hundred and eighty-four, be, and the same is hereby, amended to read as follows:

"That the National Academy of Sciences, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, be, and the same is hereby, authorized and empowered to receive by devise, bequest, donation, or otherwise, either real or personal property, and to hold the same absolutely or in trust, and to invest, reinvest, and manage the same in accordance with the provisions of its constitution, and to apply said property and the income arising therefrom to the objects of its creation and according to the instructions of the donors: *Provided, however,* That the Congress may at any time limit the amount the real estate which may be acquired and the length of time the same may be held by said National Academy of Sciences."

SEC. 2, That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, May 27, 1914.

CONSTITUTION

As amended and adopted Apr. 17, 1872, and further amended Apr. 20, 1875; Apr. 21, 1881; Apr. 19, 1882; Apr. 18, 1883; Apr. 19, 1888; Apr. 18, 1895; Apr. 20, 1899; Apr. 17, 1902; Apr. 18, 1906; Nov. 20, 1906; Apr. 17, 1907; Nov. 20, 1907; Apr. 20, 1911; Apr. 16, 1912; Apr. 21, 1915; Nov. 11, 1924; Nov. 9, 1925; Oct. 18, 1927; Nov. 18, 1929; Sept. 18, 1930; Apr. 24, 1933; Apr. 27, 1936; Apr. 28, 1937; Apr. 22, 1940; Oct. 26, 1942; Apr. 26, 1949; Nov. 15, 1960; Oct. 12, 1964; Oct. 25, 1971; Oct. 23, 1973; Apr. 27, 1976.

PREAMBLE

Empowered by the act of incorporation enacted by Congress and approved by the President of the United States, on the 3d day of March A.D. 1863, and in conformity with amendments to said act approved July 14, 1870, June 20, 1884, and May 27, 1914, the National Academy of Sciences adopts the following amended constitution and bylaws:

ARTICLE I. OF MEMBERS

SECTION 1. The Academy shall consist of members, members emeriti, and foreign associates. Members must be citizens of the United States.

ARTICLE II. OF THE OFFICERS AND ORGANIZATION

SECTION 1. The officers of the Academy shall be a president, a vice president, a foreign secretary, a home secretary, and a treasurer to be chosen from the membership.

The president shall be elected for a term to be established in each individual case by the Council and may be reelected. The election of the president shall be by a mail ballot conducted prior to the annual meeting next preceding the July 1 on which he is to take office.

The vice president, the home secretary, the foreign secretary, and the treasurer shall be elected for terms of four years and may be reelected. The election of these officers shall be by a mail ballot conducted as further provided in the bylaws prior to the annual meeting next preceding the July 1 on which they are to take office.

The date of expiration of the terms of all offices shall be June 30. Should a vacancy occur in any office, except that of the president, the Council may appoint an officer to serve until June 30 following the annual meeting at which his successor is elected. Should the office of president become vacant, the vice president shall carry out his duties until the Council can arrange for an election to take place.

COUNCIL

SECTION 2. The officers of the Academy, together with twelve members to be elected by the Academy, shall constitute a Council for the transaction of such business as may be assigned to it by the constitution, the bylaws, or the Academy.

EXECUTIVE COMMITTEE

SECTION 3. There shall be an executive committee of the Council of the Academy, composed of seven members, consisting of the president and vice president of the Academy, the home secretary of the Academy, the treasurer of the Academy, and additional members of the Council of the Academy appointed by the president.

Their terms as members of the executive committee shall be coterminous with the term of their other office.

Except those powers dealing with nominations to membership in the Academy, the executive committee between the meetings of the Council shall have all the powers of the Council of the Academy, unless otherwise ordered by the Council.

The president and home secretary of the Academy shall, respectively, be chairman and secretary of the executive committee.

SECTIONS

Section 4. The Academy shall be divided by the Council into sections representing the principal branches of scientific research. Each section shall elect its own chairman to serve for three years. The chairman shall be responsible to the Academy for the work of his section.

FINANCE COMMITTEE

Section 5. There shall be a finance committee, of which the treasurer shall be chairman, consisting of the president of the Academy (or in his absence the vice president), the treasurer, and not more than six other members of the Academy appointed by the president, one of whom shall be a member of the executive board of the National Research Council.

It shall be the duty of the finance committee to provide for the safe custody of all financial resources of the Academy and to determine all matters relating to the purchase and sale of securities held absolutely or in trust.

PRESIDENT

Section 6. The president of the Academy, or, in case of his absence or inability to act, the vice president, shall preside at the meetings of the Academy, and of the Academy Council; shall, with the Academy Council, direct the general business of the Academy; shall name all committees except as are otherwise especially provided for; and shall, as authorized by the Council refer all investigations requested by the Government of the United States to members or other persons especially conversant with the subjects. In the event of the need for expeditious action, the president may act on requests by the Government of the United States and report his actions to the Council at its next meeting.

The president shall serve as chairman of the National Research Council and of its Governing Board, except that in case of his prolonged absence or inability to act, the Academy Council shall designate the vice president as the acting chairman.

GOVERNMENT REQUESTS

The president shall be ex officio a member of all committees empowered to consider questions referred to the Academy by the Government of the United States.

SECRETARIES

Section 7. The foreign and home secretaries shall conduct the correspondence proper to their respective departments, advising with the president and Council in cases of doubt, and reporting their action to the Academy at one of the stated meetings in each year.

TREASURER

Section 8. The treasurer shall attend to all receipts and disbursements of the Academy, giving such bond and furnishing such vouchers as the Council may require. He shall collect all dues, assessments, and subscriptions, and keep a set of books showing a full account of receipts and disbursements and the condition of all funds of the Academy. He shall be the custodian of the corporate seal of the Academy.

NATIONAL ACADEMY OF ENGINEERING

Section 9. The National Academy of Engineering is established as a separate membership organization of the National Academy of Sciences, under Articles of Organization adopted by the Council of the National Academy of Sciences.

INSTITUTE OF MEDICINE

Section 10. The Institute of Medicine is established as a separate membership organization of the National Academy of Sciences under terms of a charter adopted by the Council of the National Academy of Sciences.

NATIONAL RESEARCH COUNCIL

Section 11. Pursuant to requests by the President of the United States in 1918 and 1956 the Academy shall perpetuate the National Research Council.

Article III. Of the Meetings

ACADEMY

Section 1. The Academy shall hold one stated meeting called the annual meeting, in April of each year in the city of Washington and such other meetings as may be scheduled by the Council. The Council shall have the power to determine the location for such other meetings, and to fix the date of each meeting. The members shall be notified of such other scheduled meetings at least sixty (60) days in advance of the fixed date for such meeting.

The Council shall define the objectives and general content of all meetings and shall establish, under direction of the home secretary, committees on arrangements for the meetings as it deems appropriate.

ARTICLE IV. OF ELECTIONS AND REGULATIONS

SECTION 1. All elections of officers and members shall be by ballot, and each election shall be held separately.

SECTION 2. The Council shall have general supervision over the election of the officers of the Academy. It shall set the dates for holding the elections and shall appoint any necessary nominating committees.

ELECTION PROCEDURE

SECTION 3. Election of members shall be held at the annual meeting in Washington in the following manner: There shall be two ballots—a preference ballot, which shall be transmitted by mail, and a final ballot, to be taken at the meeting.

ARTICLE V. OF REPORTS

ANNUAL REPORT

SECTION 1. An annual report shall be presented to Congress by the president and shall contain the annual reports of the treasurer and the auditing committee, a suitable summary of the reports of the committees in charge of trust funds, and a record of the activities of the Academy for the fiscal year immediately preceding, and other appropriate matter. This report shall be presented to Congress by the president after authorization by the Council. It shall also be presented to the Academy at the annual meeting next following.

TREASURER'S REPORT

SECTION 2. The treasurer shall prepare a full report of the financial affairs of the Academy at the end of the fiscal year. This report shall be submitted to the Council for approval and afterward presented to the Academy at the next stated meeting. He shall also prepare a supplementary financial statement to December 31 of the ensuing fiscal year for presentation at the annual meeting.

GOVERNMENT REQUESTS

SECTION 3. Propositions for investigations or reports by the Academy shall be submitted to the Council for approval, after which they shall be acted on by the president, who will report their results to the sponsoring body.

ARTICLE VI. OF TRUST FUNDS AND THEIR ADMINISTRATION

TRUSTS

SECTION 1. Devises, bequests, donations, or gifts having for their object the promotion of science or the welfare of the Academy may be accepted by the Council for the Academy. Before the acceptance of any such trust the Council shall consider the object of the trust and all conditions or specifications attaching thereto. The Council shall make a report of its action to the Academy.

MEDALS

SECTION 2. Medals and prizes may be established in accordance with the provisions of trusts or by action of the Academy.

TRUST FUND COMMITTEES

SECTION 3. Unless otherwise provided by the deed of gift, the income of each trust fund shall be applied to the objects of that trust by the action of the Academy on the recommendation of a standing committee on that fund.

ARTICLE VII. OF DELEGATIONS OF AUTHORITY

SECTION 1. The Council, the president, and other officers may delegate their several authorities to appropriate officials of the National Academy of Sciences or the National Research Council except with respect to those authorities concerning membership affairs.

ARTICLE VIII. OF ADDITIONS AND AMENDMENTS

SECTION 1. Additions and amendments to the constitution shall be made only at a stated meeting of the Academy. Notice of a proposition for such a change must be submitted to the Council, which may amend the proposition and shall report thereon to the Academy. Its report shall be considered by the Academy in committee of the whole for amendment.

The proposition as amended, if adopted in committee of the whole, shall be voted on at the next stated meeting, and if it receives two-thirds of the votes cast it shall be declared adopted.

Absent members may send their votes on pending changes in the constitution to the home secretary in writing, and such votes shall be counted as if the members were present.

BYLAWS

Revised and adopted Apr. 25, 1950; amended Apr. 26, 1954; Apr. 28, 1959; Apr. 26, 1960; Apr. 24, 1962; Nov. 30, 1962; Oct. 12, 1964; Apr. 27, 1965; Oct. 11, 1965; Apr. 26, 1966; Oct. 17, 1966; Oct. 23, 1967; Apr. 23, 1968; Apr. 27, 1971; Oct. 25, 1971; Apr. 2[illegible], 1972; Oct. 2[illegible], 1973; Apr. 22, 1975, Apr. 27, 1976.

[In accordance with a resolution of the Academy taken at its meeting on April 21, 1915, the bylaws are arranged in groups, and each group is numbered to correspond with the article of the constitution to which it relates.]

I. OF MEMBERS

1. The holders of the medal for eminence in the application of science to the public welfare shall be notified, like members, of the meetings of the Academy and invited to participate in its scientific sessions.

2. The Academy may elect not more than fifteen (15) foreign associates each year. Not more than two (2) of these may be resident foreign associates.

3. A foreign associate of the Academy who becomes a citizen of the United States shall have all the privileges and duties of a member of the Academy unless he shall request otherwise, and shall be included in the list of members in the section of his choice.

4. Members who wish to be relieved of the duties of active membership may, at their own request, be transferred to the roll of members emeriti by action of the home secretary.

5. Members emeriti and foreign associates shall have the privilege of participating in the meetings and of reading and communicating papers and shall be entitled to a copy of the publications of the Academy, but shall not be subject to its assessments. They shall not vote, nor sign instruments of election of members or officers of the Academy.

6. Resignations from membership shall be addressed to the home secretary and reported by him to the Council.

Not earlier than four years after a member's resignation the Council, by a two-thirds vote, may provide for reinstatement to membership.

7. No member whose dues are in arrears for three successive years shall vote on any business of the Academy.

II. OF THE OFFICERS AND ORGANIZATION

COUNCIL OF THE ACADEMY

1. Stated meetings of the Council shall be held at least four times annually, and six members shall constitute a quorum for the transaction of business. Special meetings of the Council may be convened at the call of the president and two other members of the Council or of four members of the Council.

The Council, after considering the recommendations of a committee of its members, shall have the power to fix the compensation and allowances of the president of the Academy and of other officers for whom the Council may find it desirable to provide compensations and allowances. Members of this committee shall be selected from those members of the Council who are not in receipt of any compensation from the Academy.

The Council shall have the power to appoint and to fix the salaries of the personnel (such as chief executive officer of the National Research Council, executive secretary, business manager, or other personnel) that may be deemed necessary for the conduct of the affairs of the Academy.

It shall be the responsibility of the president to prepare and present to the Council of the Academy an annual general budget for the Academy and the National Research Council. The Council shall provide for a review of the proposed budget by a committee designated from among its members. After consideration of the committee recommendations, the Council shall adopt the annual general budget for the Academy including that for the National Research Council.

The Council shall designate which of its members and officers, in addition to the president and vice president, shall represent the Council in the governance of the National Research Council.

EXECUTIVE COMMITTEE

2. In the absence of the president and the vice president or home secretary, the executive committee may select from among its members a chairman or a secretary pro tempore.

The executive committee shall keep regular minutes and shall report all of its proceedings to the Council of the Academy for their information.

Meetings of the executive committee shall be held at any time, on call of the chairman, on reasonable notice.

Four members of the executive committee shall constitute a quorum. Letter ballots shall not be valid unless ratified at a meeting.

SECTION CHAIRMEN

3. The term of service of each chairman of a section shall be three years, to date from July 1 next following his election. Chairmen of sections shall be chosen by mail ballot, the member receiving the highest number of votes cast to be deemed elected. It shall be the duty of each retiring chairman to conduct the election of his successor, in the autumn of his last year of service, and to report the results of the election to the home secretary. Should any section fail to elect a chairman, the president is empowered to appoint a temporary chairman to serve until July 1 next following. No chairman shall be eligible for reelection for two consecutive terms.

CLASSES AND CLASS OFFICERS

4. After consideration of recommendations from the Council, the Academy may establish several classes, each of which shall be composed of members of one or more sections grouped according to the relationships among their respective branches of research. With the concurrence of the home secretary, a member may transfer from one class to another without changing his sectional affiliation; but after transfer he may not serve as a representative of his section in any committee of the class to which his section is assigned.

Each class shall hold an annual meeting at the time of the annual meeting of the Academy.

Each class shall elect from its own membership by mail ballot a chairman and a secretary from nominations made at the annual meeting of the class. The chairman and secretary shall serve for three years from the July 1 following their election. Should either office become vacant, the president is empowered to appoint a temporary chairman or secretary to serve until a successor is elected. No chairman shall succeed himself.

SECRETARIES

5. It shall be the duty of the home secretary to give notice to the members of the place and time of all meetings, of all nominations for membership, and of all proposed amendments to the constitution.

It shall be the duty of the home secretary to keep the minutes of each business and scientific session, and after approval to enter these upon the permanent records of the Academy.

The home secretary shall keep a record of all grants of money or awards of prizes or medals made from trust funds of the Academy. The record for each grant of money shall include the following items: Name of fund, date and number of the grant, name and address of recipient, amount of grant, and date or dates of payment, purpose of grant, record of report of progress.

6. The foreign secretary shall be responsible for conducting business with foreign Academies and shall supervise the nomination of foreign associates.

TREASURER

7. The treasurer shall, upon appropriate authority, defray all the proper expenses of committees appointed to make scientific investigations at the request of departments of the Government, and in each case look to the department requesting the investigation for reimbursement to the Academy.

The treasurer is authorized to act ex officio as the treasurer of the National Research Council.

The accounts of the treasurer shall, immediately after the close of each fiscal year, be audited by certified public accountants selected for the purpose by the Council. The report of these auditors shall be transmitted to the members together with the annual report of the treasurer.

8. All investments and reinvestments of either principal or accumulations of income of the trust and other funds of the Academy shall be made by the treasurer, in accordance with the policies specified by the finance committee, in the corporate name of the Academy, in the manner and in the securities designated or specified in the instruments creating the several funds, or in the absence of such designation or specification, in bonds of the United States or of the several States, or in bonds or notes secured by first mortgages on real estate, in investments legal for savings banks under the laws of Massachusetts or New York, or in other securities recommended by the financial adviser. Notwithstanding the foregoing, the treasurer, or in case of his absence or inability to act, the president, shall have authority to execute investment transactions upon the written recommendation of the financial adviser without prior consultation with or approval by the finance committee, provided, however, that all such transactions promptly shall be reported to the finance committee. The treasurer shall report to the Council on the status of the funds invested for each trust fund committee, the amount of accumulated income, and the amount available for making awards as

provided by the trust. On the basis of this report the Council shall allocate to the various trust fund committees an amount sufficient for making awards in that year.

The treasurer may invest the capital of all trust funds of the Academy which are not required by the instruments creating such funds to be kept separate and distinct in a consolidated fund, and shall apportion the income received from such consolidated fund among the various funds composing the same in the proportion that each of said funds shall bear to the total amount of funds so invested: *Provided, however,* That the treasurer shall at all times keep accurate accounts showing the amount of each trust fund, the proportion of the income from the consolidated fund to which it is entitled, and the expenses and disbursements properly chargeable to such fund.

The treasurer shall have authority, under policies specified by the finance committee, to sell, transfer, convey, and deliver in the corporate name and for the benefit of the Academy any stocks, bonds or other securities standing in the corporate name.

FINANCE COMMITTEE

9. The finance committee shall be empowered, subject to the approval of the Council, to employ competent investment counsel (hereinafter called the financial adviser) to advise with the committee upon the purchase and sale of all securities, mortgages, or other investments.

10. On the recommendation of the finance committee, the Council shall contract with a bank, trust company, or corresponding fiduciary institution, to serve as the custodian of securities, including all of the Academy's personal property and property held in trust in the form of bonds, mortgages, and other securities, to collect the income from them, to protect the Academy in respect to expirations, reissues, and notifications, and to buy or sell securities on the order of the treasurer, in accordance with policies specified by the finance committee.

CONTRACTS

11. No contract shall be binding upon the Academy which has not been signed by the president or his designated agent pursuant to approved policies and regulations established by the Council.

DUES

12. The assessments required for the support of the Academy shall be fixed by the Academy on the recommendation of the Council and shall be payable within the fiscal year for which they are assessed.

III. OF THE MEETINGS

1. Scientific sessions of the Academy, unless otherwise ordered by a majority of the members present, shall be open to the public; sessions for the transaction of business shall be closed.

2. The home secretary shall make provision for the registration of members in attendance at a meeting, and the names of the members who registered shall be entered in the minutes of the meeting.

3. At a business session forty members shall constitute a quorum and only members shall vote.

4. At the business sessions of the Academy the order of procedure shall be as follows:

(1) Chair taken by the president or, in his absence, by the vice president.

(2) Minutes of the preceding session approved.

(3) Stated business.

(4) Reports of the president, vice president, secretaries, treasurer, and committees.

(5) Business from Council.

(6) Other business.

The rules of order of the Academy shall be Robert's Rules of Order Revised, unless otherwise provided by the constitution or bylaws of the Academy.

In the absence of any officer, a member shall be chosen to perform his duties temporarily, by a plurality of viva voce votes, upon open nomination.

DEATHS

5. At each meeting the president shall announce the death of any members since the preceding meeting. As soon as practicable thereafter, the home secretary shall designate a member to write, or to secure from other source approved by the home secretary, a biographical memoir of each deceased member.

IV. Of Elections and Regulations

OFFICERS AND COUNCIL OF THE ACADEMY

1. Election of the Council of the Academy: Four members of the Council shall be elected annually to serve for three years from the next July 1. The election of members of the Council shall be by mail ballot conducted prior to the annual meeting next preceding the July 1 on which they are to take office. Should a vacancy in the Council occur, it shall be filled for the unexpired term at the next annual election of the Academy, except that the Council may make an interim appointment to this vacancy from among the members to serve until the vacancy is filled by election.

2. Nominating Committee: At or before each annual meeting, the Council shall appoint a nominating committee of not fewer than nine members to serve for the ensuing year. No officer of the Academy or member of the Council shall be a member of the nominating committee during his term of office. In the appointment of the nominating committee due regard shall be given to broad representation of the Academy's geographic distribution and scientific interests. Notice of the membership of this committee shall be sent by the home secretary to all members of the Academy.

3. Nomination of Officers (other than President) and Council Members: At least five months before the annual meeting of the Academy, a request for nominations to be submitted within six weeks for offices other than the president, and for positions on the Council that will fall vacant shall be circulated by the home secretary to the membership at large. Nominations from the membership shall be made in writing and signed by twelve members, who have verified that their candidate is willing to serve if elected. The signators of the petition shall include no more than five from any one section nor more than three from any one institution. Only one nominator for any candidate may be an officer of the Academy or member of the Council, at least one nominator must be from a class other than that of the nominee, and residents from at least three states must be represented among the nominators. No nominee for officer of the Academy, other than president, shall be more than 68 years of age at the time of his election.

At a time and place designated by the home secretary, the nominating committee shall meet and prepare a slate of nominees for officers and Council positions to fall vacant. The slate shall include, but need not be limited to, all eligible persons nominated in writing by the membership as provided above. The committee shall also assure itself of the availability of the persons nominated for the respective office or Council position. The nominating committee shall see that at least one qualified person is nominated for the position of officer of the Academy to fall vacant and any candidate nominated by the nominating committee shall be so designated on the ballot. The nominating committee shall see that the slate of nominees for positions on the Council to fall vacant shall include not fewer than twice as many nominees as there are positions to be filled and that the geographic distribution and scientific interests of the Academy are broadly represented on the slate. If, for two consecutive years, the Council does not include a member of a given class, then, in the next annual election, the home secretary shall establish a separate slate of Council members for election from that class to one of the four memberships on the Council becoming vacant. The nominating committee shall assure that not fewer than two candidates from the class shall appear on this separate slate. The nominating committee shall report its slate of nominees to the Council prior to the submission by the nominating committee of such slate to the home secretary for preparation of a ballot.

The home secretary shall prepare and mail to all members of the Academy a secret ballot containing the slate of nominees submitted to him by the nominating committee for offices and Council positions to fall vacant and shall accompany such ballot by a brief biography listing the professional accomplishments of each nominee. This ballot shall be sent to the entire membership at the same time that the preference ballot for election of members is distributed by the home secretary.

The ballot shall be marked by each member and thus inscribed shall be sealed in an envelope, which shall be enclosed in another bearing the name of the sender, and transmitted to the home secretary. The home secretary shall cause only those ballots to be tabulated that he receives at least two weeks in advance of the annual meeting and shall certify the results to the Council.

With respect to the election of officers of the Academy, other than president, the Council shall declare as elected the candidate receiving a majority of the votes cast. If no majority is received by a candidate, those two nominees receiving the highest votes shall be presented to the membership of the Academy at the annual meeting and the candidate receiving a majority vote of the members present and voting shall be declared elected.

With respect to the election of members of the Council, the Council shall declare as elected the four candidates receiving the highest number of votes among those ballots cast.

A tie vote affecting the election of the councilors shall be resolved by an additional ballot at the next business meeting of the Academy.

4. Nomination of a President: When a president is to be nominated, the Council shall set the term of office of the next president. No terms shall be longer than six years; no individual shall serve for more than twelve years or beyond the age of seventy years. The nominating committee shall solicit suggestions on prospective candidates from each section chairman. Prior to submitting its recommendation to the Council, the committee shall assure itself that each proposed nominee will be willing and able to serve if elected; and will be agreeable to such conditions as may be established by the Council.

At the October meeting of the Council the nominating committee shall present one or more nominees to the Council for approval. The home secretary shall promptly inform the membership of the identity of the nominee(s) recommended by the nominating committee and approved by the Council.

Additional nominations, each supported by the signatures of not fewer than fifty members of the Academy, may be submitted to the home secretary before December 1 immediately preceding the election; with each such nomination there must be submitted to the home secretary evidence that the nominee is willing and able to serve under such conditions as may be established by the Council.

Additional nominations, each supported by the signatures of not fewer than fifty members of the Academy, may be submitted to the home secretary before December 1 immediately preceding the election; with each such nomination there must be submitted to the home secretary evidence that the nominee is willing and able to serve under such conditions as may be established by the Council.

5. Election of a President: Prior to December 15 next preceding the June in which the office of president is to fall vacant, the home secretary

shall mail to all members of the Academy a secret ballot containing the name(s) approved by the Council and designated as such, along with the names of other properly certified nominees together with a list of the names of those who have supported each such independent nomination.

To be valid, ballots must be returned to the home secretary by January 15, and election shall be by a majority of those voting. In case no candidate receives a majority, the home secretary shall inform the membership of the result of the ballot; the Council shall then arrange for additional ballots, and may, if there are more than two nominees, remove from each successive ballot the name of the nominee receiving the smallest number of votes on the previous ballot. The home secretary shall promptly inform the membership of the outcome of the election.

6. Special Elections: The Council shall provide for special elections, following as near as possible the procedures for regular election, whenever a vacancy occurs in any of the five elected offices of the Academy.

7. Removal of Officers: By a vote of 8 or more of the Councilors, any officer may be suspended from his position on the grounds of malfeasance, nonfeasance, or inability to perform the duties of the office. A complete explanation for such action by the Councilors, together with a statement which may be volunteered by the suspended officer, will promptly be submitted to the membership together with a mail ballot for ratification. If two-thirds of the members voting support the action of the Councilors, that officer will have been removed from office and the Council shall arrange for a special election to fill that position.

ELECTION OF MEMBERS

8. Class Membership Committees: Each class shall have a membership committee broadly representative of the various disciplines included in the class. Committee members shall not serve for more than two successive years, and shall be selected as follows:

(1) One member representing each section included in the class, elected annually by the section at the time of the informal nominating ballot for Academy membership. In the event he cannot serve, the chairman of the section shall appoint an alternate;

(2) Six members-at-large, no more than two of whom (unless the class has fewer than three sections) shall be from the same section, elected annually by mail ballot of the entire class from a list of candidates nominated at the annual meeting of the class. In the event a member-at-large cannot serve, the chairman of the class shall appoint an alternate;

(3) Three members designated annually by the Council before December 31. In the event a Council designee cannot serve, the president shall appoint an alternate.

Only the individuals enumerated in (1), (2), and (3) above on the class membership committee may vote at the class membership committee meeting.

9. Temporary Nominating Groups: The Council, after consultation with the chairmen of the sections and the chairmen of the classes, may organize temporary nominating groups either by subdividing a present section into two or more groups or by forming new intersectional or extrasectional groups. Such temporary nominating groups may then nominate new members in accordance with the rules laid down for sections.

A member who has been asked to serve on a temporary nominating group by the Council shall retain membership in his section and class and shall continue to be entitled to the voting privileges of such membership.

When a temporary nominating group is organized by the Council, the member of the group who is designated as chairman by the Council shall immediately notify all members of the Academy in that group of their assignment by the Council as members of the group, listing all members of the group in this notification, and shall further transmit to all members of the group the specifications, as prepared by the Council, of the special branch of science which the group is to canvass. He shall then obtain from the members of the group before October 1, proposals of names of persons in that special branch of science, to be considered in the election of new members by the Academy. Such proposals shall be submitted to the group for informal ballot at an assembled meeting called by the chairman not later than November 1. The informal and formal ballots shall be governed by the same rules as ballots of sections. The chairman shall report to the home secretary the results of the formal ballot of the group under the same rules as apply to sections, together with a recommendation as to the class to which each nomination should be referred for consideration by the class membership committee.

10. Voluntary Nominating Groups: A group of twenty or more members of the Academy may nominate a candidate provided that no more than five members of such group shall be affiliated with any one institution, and no more than twelve members shall be from any one section of the Academy, and that no member shall sign his name on more than one voluntary nominating group petition in any one year. Each such nomination, accompanied by a properly edited statement of the nominee's scientific accomplishments and a list of his principal contributions to science, shall be submitted by the group to the home secretary prior to December 15, together with a recommendation as to the class to which the nomination should be referred for consideration by the class membership committee. At least five members of this group shall be from this class.

11. Annual Election Quotas: The Council shall recommend to the Academy each year the total number of new members, together with the quota of new members for each class, to be elected in the following year, within the maximum number of new members established in the bylaws. The recommended numbers shall be open for discussion at the annual meeting of the Academy prior to their final determination by the Council.

The class membership committees shall report to the Council, at the time the preference lists are submitted to the home secretary, on the number and quality of the nominees and on such other matters as they deem relevant for consideration by the Council in establishing quotas for the following year.

12. Nominations to Membership: Nominations to membership in the Academy shall be made in writing and approved by two-thirds of the members voting in a section on the branch of research in which the person nominated is eminent, or by a majority (however distributed) of the members voting in any two sections, or by a voluntary nominating group, or by a majority of the Council.

Persons nominated to the Academy and specifically rejected in an individual ballot at the time of the annual election may not be further considered by the class membership committees until they have again been proposed for nomination in the prescribed manner in a calendar year subsequent to that in which they were rejected. Persons nominated to the Academy but not voted upon by the Academy at the ensuing election may be renominated in the year following the previous nomination: but if again not voted upon in the final ballot, they shall not be further considered by the class membership committees until they have been proposed for nomination in the prescribed manner in a calendar year subsequent to that in which they last failed to be voted upon by the Academy.

Sectional and intersectional nominations to membership shall be secured in accord with the procedures specified below.

13. Proposals for Nomination: (1) Intersectional: Proposals for nomination to membership may be made in writing by any five members of the Academy or on their behalf by one of the chairmen of the cognate sections and addressed to the home secretary; each such proposal shall be accompanied by a record of the scientific activities of the person proposed and by a list of his principal contributions to science, in triplicate; and with a statement as to the sections to which the name proposed shall be submitted for consideration. Such proposals as have been received by the home secretary prior to September 15 shall be sent by him to the chairman of each section designated, no later than October 1, with a copy of the record and list of contributions.

(2) Sectional: Proposals for nomination to membership shall be in writing and shall be sent to the chairman of the section not later than October 1. The proposal for nomination of any individual will be accepted for consideration by the section only if it is accompanied by a list of titles and references of the more important published scientific articles of the individual and by a factual summary, not over 250 words in length, of his accomplishments.

Each section chairman shall edit material thus received and, at the time of the informal ballot, distribute it, together with the material from the home secretary, relative to intersectional proposals, to the members of the section. The home secretary's office, if called upon, will assist the chairmen of the sections in the multigraphing of his material.

Each chairman shall keep a record of the names listed on the informal ballot. In preparing the informal ballot for the following year, he shall include (a) those who have been on the informal ballot one year and received at least 10% of the votes cast, (b) those who have been on the informal ballot for two years and received a higher percentage of votes cast in the second year than in the first year, and (c) those who have been on the informal ballot for three or more years and received at least 40% of the votes cast in the last year. A proposal for nomination which is thus stricken from the list of the informal ballot shall not again be considered by the section (or sections) before the second calendar year following the year in which it was last listed, and shall be considered then only if again proposed for nomination in the appropriate manner.

At an appropriate time each year, each section chairman shall bring to the attention of the members of the section a list of all names which have been submitted to him, by members of the Academy or by others, as worthy of being proposed for nomination, inquiring for which of these names each section member is willing to prepare a proposal for nomination. Sections may adopt procedures to avoid unprofitable repetitions in succeeding years.

14. Nomination Ballots: The chairman of each section of the Academy shall submit to the members of his section, not later than October 25 of each year, an informal ballot containing in alphabetical order and without indications of rank on ballots of the previous year, the names of all persons remaining on the list or added thereto in accordance with the provisions above defined. Each member of the section shall be expected to return his ballot to the chairman within two weeks, with his signature and with crosses against the names of those persons whom he is prepared to endorse for nomination. The vote resulting from this ballot shall be regarded as informal.

The chairman shall then submit to the members of his section a new ballot showing the results of the informal vote; and each member shall be expected to return this ballot to the chairman with his signature and with crosses placed against the names of those persons whom he judges to be worthy of nomination.

In order to secure an adequate number of nominations the chairman, when necessary, shall obtain by personal solicitation a fuller vote of his section or shall submit to the section a supplementary formal ballot.

The chairman shall then certify to the home secretary, prior to December 15, the names of all persons who have been voted for on the formal ballots, together with a statement of the number of votes each candidate received and of the number of members voting. Of these, all persons who receive the votes of two-thirds of the members voting in any one section, or the votes of one-half (however distributed) of the members voting in any two sections, shall be considered nominated.

A properly edited statement of the accomplishments of each individual nominated to the Academy by the sections shall be sent by the section chairmen to the home secretary along with the nominations of the section. The home secretary shall establish guidelines to be used in the preparation of supporting statements for each nomination. These statements will be reproduced and distributed to the members of the Academy at the time of the preference ballot.

15. Preference Lists: The home secretary shall convene the class membership committees before March 1 to consider in detail the qualifications of each nominee. Each committee shall be chaired by its class chairman and in his absence by the class secretary. In the absence of both each committee shall then elect its own chairman. The home secretary shall provide each committee with statements of the accomplishments of each nominee. Where appropriate, consideration of individual nominees may be transferred from one class membership committee to another; differences of opinion between committees on this point shall be decided by the home secretary.

From all the nominees assigned to it, each class membership committee shall prepare a preference list in which the nominees shall be entered in the order determined by the committee, up to a total of 150% of the quota previously assigned to the class by the Council, as this limit may be interpreted by the home secretary in his discretion and specified to the committee by him. The list shall then be certified by the committee chairman to the home secretary.

16. Preference Ballot: The home secretary shall then distribute to the entire membership a ballot containing separately the preference list of each class membership committee, accompanied by (a) a copy of the statement of accomplishments of each nominee, and (b) a record of the voting in each section and temporary nominating group.

On the ballot so distributed by the home secretary, each member shall select and indicate those names which he prefers, to an extent not greater than one-half nor less than one-third of each list, as these limits shall be interpreted by the home secretary in his discretion and announced by him.

The ballot thus inscribed shall be sealed in an envelope, which shall be enclosed in another bearing the name of the sender, and which shall be transmitted to the home secretary. The home secretary shall cause only those ballots to be tabulated that he receives at least two weeks in advance of the annual meeting. If in any case it is impossible to determine who cast the ballot, or if more or fewer names have been selected than the numbers specified by the home secretary, the ballot shall be rejected; but minor defects in a ballot shall be disregarded when the intent of the voter is obvious.

17. Final Lists: On the basis of the preference ballot for each class the

home secretary shall prepare two combined lists: on the first the nominees shall be entered in the order of the number of votes received by each in the preference ballot, provided that the total number of nominees so entered for each class shall not exceed the quota previously fixed for that class by the Council; on the second the remaining nominees shall be entered in the order of the number of votes received by each in the preference ballot.

18. Final Ballot: The final lists shall be presented to the membership of the Academy at the annual meeting. If because of a tie vote on the preference ballot it is impossible for the home secretary to determine on which list a nominee should appear, the determination shall be made by a majority vote of the members present. The president, acting for the Council, may request permission to exchange a name on the second list for one on the first list, or to add a name from the second list to the first list, on grounds of the general interests of the Academy, without regard to previously assigned quotas, provided that the total number on the first list shall not thereby exceed the maximum number that may be elected, as established by the bylaws. If a majority of the members present favor the proposed change it shall be made. The chairman of any section or any temporary nominating group may request permission to interchange any nominees of his section or temporary nominating group between the first list and the second, without altering in any way the positions of other nominees. If a majority of the members present favor such an interchange it shall be made.

The chairman of any section or any temporary nominating group may request permission to interchange any nominees of his section or temporary nominating group between the first list and the second, without altering in any way the positions of other nominees. If a majority of the members present favor such an interchange it shall be made.

Those on the first list, as modified in accordance with the previous paragraph, may then be declared elected by a two-thirds vote of the members present and voting; provided, however, that any members may call for discussion of any nominee on the first list, and such nominee shall be removed from the first list unless a two-thirds majority of the members present and voting oppose his removal. A nominee removed from the first list in this way may not be replaced by another. The vote shall then be taken on the remainder of the first list. Nominees who have been removed from the first list for discussion as provided above shall then be voted on individually by ballot in the order of the number of votes received by each in the preference ballot, and any such nominee shall be declared elected if he receives two-thirds of the votes cast. Unless terminated earlier as provided below, the election shall terminate when all the nominees on the first list, modified as provided above, together with all those removed from the first list for discussion as provided above, have been voted upon.

If the first list, after modification as provided above, does not receive a two-thirds vote of the members present and voting, a ballot shall be taken on each of the nominees on the modified first list, and on those removed from the first list for discussion in the order of the number of votes received by each in the preference ballot. Each nominee who receives two-thirds of the votes cast shall be declared elected. If, however, a nominee has received a majority of the votes of those members voting in the preference ballot, he may be declared elected by a two-thirds voice vote.

In no case shall a nominee be declared elected if he receives fewer than one hundred votes in all.

It shall be in order at any point in the course of an election to move that the election be closed. If two-thirds of those present vote in favor of such motion, it shall prevail, and the election shall thereupon terminate.

The sizes of quotas shall be held strictly confidential, as shall all discussions of the claims and qualifications of nominees at meetings of the Academy, and remarks and criticism then made may be communicated to no person who was not a member of the Academy at the time of the discussion.

Should a nominee listed on the preference ballots die after the meeting of the class membership committee he may be elected posthumously by a majority vote of the members present and voting without reference to quotas. There shall be no other posthumous election.

19. Total Number Elected: Not more than 75 members shall be elected at the 1972 annual meeting. Not more than 100 members shall be elected at the 1973 annual meeting. Not more than 95 members shall be elected at the 1974 annual meeting. Not more than 85 members shall be elected at the 1975 annual meeting. Not more than 75 members shall be elected at the 1976 annual meeting. Not more than 60 members shall be elected at the 1977 annual meeting and in later years.

20. Foreign Associates: Foreign associates may be nominated by the Council and may be elected at the annual meeting by a two-thirds vote of the members present. The foreign secretary shall solicit from each section recommendations for nomination of foreign associates. Recommendations to be submitted by each section shall be based upon a ballot of the section membership, taken at the time of the formal ballot, the results of which shall be reported to the foreign secretary and accompanied by suitable biographical information, before January 1. No section shall submit more than two nominations per year.

21. Acceptance of Election: Every member elected shall accept his membership, personally or in writing, before the close of the next stated meeting after the date of his election. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

Members of the Academy are permitted to choose the section with which they wish to be affiliated, and no one shall be a member of more than one section; but this does not preclude service on a temporary nominating group at the request of the Council. Members may also change their sectional affiliation by notification to the home secretary but such changes cannot be made oftener than once every three years unless the change is to a newly established section or to a section newly assigned to a new or different class.

V. OF SCIENTIFIC COMMUNICATIONS AND REPORTS

1. The Council shall from time to time schedule sessions for contributed papers at scientific meetings of the Academy at which any member shall have the right to read a paper with notice of the same having been previously given to the home secretary.

2. Persons who are not members may read papers in scientific sessions of the Academy on invitation of the Council or of the home secretary, or on recommendation by an Academy member and approval by the home secretary.

PUBLICATIONS

3. The Academy may provide for the publication, under the direction of the Council, of Proceedings, Scientific Memoirs, Biographical Memoirs, and Reports.

4. The Proceedings shall be primarily a medium of first publication for original articles, in brief form, of permanent scientific value.

The Scientific Memoirs shall provide opportunity for the publication of longer and more detailed scientific investigation.

The Biographical Memoirs shall contain an appropriate record of the life and work of the deceased members of the Academy.

The publication of the Proceedings, Scientific Memoirs and Biographical Memoirs shall be under the general charge of the Council, which shall have final jurisdiction upon all questions of policy relating thereto.

TREASURER'S REPORT

5. The annual report of the treasurer shall be prepared in accordance with generally accepted accounting standards for the fiscal year of the Academy which shall end on June 30 of each year. It shall be presented to the Academy at the next stated meeting after approval by the Council and shall be published with that of the president to Congress and distributed to the members of the Academy in printed form.

AUDITING COMMITTEE

6. The president with the approval of the Council shall appoint a committee of three (3) members of the Academy to serve as an auditing committee. It shall be the function of this committee to review the report of the public accountants and make such recommendations to the Council as the committee may deem appropriate. The committee may cause to be made any

other examinations of the financial records, the accounting records, and the system of internal control of the Academy which in its judgment, are necessary for the determination of the adequacy and accuracy of the treasurer's accounts.

VI. OF TRUST FUNDS

STANDING COMMITTEE—RESEARCH FUNDS

1. Standing committees of the Academy on awards shall consist of at least three or not more than five members. In order to secure continuity and rotation in office in such committees, when not in conflict with the provisions of the deeds of gift, the members of the committee shall be appointed for staggered terms, each term of appointment to cover at least one award.

2. The annual reports of the committees on research funds shall, so far as the Academy has authority to determine their content, be in such form as to furnish the home secretary the information he needs to discharge the duties assigned him by these bylaws (II.5).

3. The committees on awards from trust funds shall be empowered to evaluate recommendations and to determine the recipients of the awards provided by the trust fund, consistent with the allocation of funds as determined by the Council.

VII. AMENDMENTS

1. On resolution of the Academy, on resolution of the Council, or on written proposal signed by five members, these bylaws may be amended at any stated or special meeting of the Academy by a majority of the votes cast, provided thirty days' notice of the substance of the amendment be sent to all members.

ORGANIZATION OF THE ACADEMY

JULY 1, 1976

OFFICERS

	Term expires
President—PHILIP HANDLER	June 30, 1981
Vice-President—SAUNDERS MAC LANE	June 30, 1977
Home Secretary—DAVID R. GODDARD	June 30, 1979
Foreign Secretary—GEORGE S. HAMMOND	June 30, 1978
Treasurer—E. R. PIORE	June 30, 1980

Executive Officer
John S. Coleman

Comptroller
David Williams

Business Manager
Bernard L. Kropp

COUNCIL

Anderson, Philip W.	(1979)
Anfinsen, C. B.	(1977)
Bloembergen, Nicolaas	(1978)
*Crawford, Bryce, Jr.	(1978)
Fowler, William A.	(1977)
*Goddard, David R.	(1979)
Gunsalus, Irwin C.	(1978)
Hammond, George S.	(1978)
*Handler, Philip	(1981)
Lehninger, A. L.	(1979)
*Mac Lane, Saunders	(1977)
*Piore, E. R.	(1980)
Press, Frank	(1978)
*Revelle, Roger	(1977)
Russell, Elizabeth S.	(1977)
Stetten, DeWitt, Jr.	(1979)
*Westheimer, Frank H.	(1979)

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* Members of the Executive Committee of the Council of the Academy.

SECTIONS

The Academy is divided into the following Sections, to which members are assigned at their own choice:

(11) Mathematics
(12) Astronomy
(13) Physics
(14) Chemistry
(15) Geology
(16) Geophysics
(21) Biochemistry
(22) Cellular and Developmental Biology
(23) Physiological Sciences
(24) Neurobiology
(25) Botany
(26) Genetics
(27) Population Biology, Evolution, and Ecology
(31) Engineering
(32) Applied Biology
(33) Applied Physical and Mathematical Sciences
(41) Medical Genetics, Hematology, and Oncology
(42) Medical Physiology, Endocrinology, and Metabolism
(43) Medical Microbiology and Immunology
(51) Anthropology
(52) Psychology
(53) Social and Political Sciences
(54) Economic Sciences

In the alphabetical list of members, the numbers in parentheses, following year of election, indicate the respective Class and Section of the member.

CLASSES

The members of Sections are grouped in the following Classes:

I. Physical and Mathematical Sciences (Sections 11, 12, 13, 14, 15, 16).
II. Biological Sciences (Sections 21, 22, 23, 24, 25, 26, 27).
III. Engineering and Applied Sciences (Sections 31, 32, 33).
IV. Medical Sciences (Sections 41, 42, 43).
V. Behavioral and Social Sciences (Sections 51, 52, 53, 54).

OFFICERS

Class I:	*Chairman*—M. L. Goldberger	(1977)
	Secretary—John D. Roberts	(1977)
Class II:	*Acting Chairman*—Clifford Grobstein	(1978)
	Secretary—Philip P. Cohen	(1977)
Class III:	*Chairman*—John W. Tukey	(1978)
	Secretary—Jack R. Harlan	(1977)
Class IV:	*Chairman*—Leon O. Jacobson	(1977)
	Secretary—M. M. Wintrobe	(1977)
Class V:	*Chairman*—Ward H. Goodenough	(1977)
	Secretary—James Tobin	(1977)

MEMBERS

Abeles, Robert Heinz, 1976 (21), Graduate Department of Biochemistry, Brandeis University, Waltham, Massachusetts 02154

Abelson, Philip Hauge, 1959 (15), Office of the President, Carnegie Institution of Washington, 1530 P Street, N.W., Washington, D.C. 20005

Adair, Robert Kemp, 1976 (13), Department of Physics, Yale University, 217 Prospect Street, New Haven, Connecticut 06520

Adams, Robert McCormick, 1970 (51), The Oriental Institute, 1155 East 58th Street, Chicago, Illinois 60637

Adelberg, Edward Allen, 1971 (26), Department of Human Genetics, Yale University School of Medicine, 333 Cedar Street, New Haven, Connecticut 06510

Adler, Stephen Louis, 1975 (13), School of Natural Sciences, The Institute for Advanced Study, Princeton, New Jersey 08540

Ahlfors, Lars Valerian, 1953 (11), Department of Mathematics, Harvard University, Science Center, 1 Oxford Street, Cambridge, Massachusetts 02138

Ahrens, Edward Hamblin, **Jr.,** 1973 (42), Rockefeller University, New York, New York 10021

Alberty, Robert Arnold, 1965 (14), Room 6-215, School of Science, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

Alder, Berni Julian, 1970 (14), Lawrence Livermore Laboratory, P. O. Box 808, Livermore, California 94550

Alexander, Richard Dale, 1974 (27), Museum of Zoology, University of Michigan, Ann Arbor, Michigan 48104

Allard, Robert Wayne, 1973 (27), Department of Genetics, University of California, Davis, California 95616

Allen, Clarence Roderic, 1976 (15), Seismological Laboratory, California Institute of Technology, Pasadena, California 91125

Aller, Lawrence Hugh, 1962 (12), Department of Astronomy, University of California, Los Angeles, California 90024

Alvarez, Luis Walter, 1947 (13), Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720

Ames, Bruce Nathan, 1972 (21), Department of Biochemistry, University of California, Berkeley, California 94720

Anders, Edward, 1974 (16), Enrico Fermi Institute, University of Chicago, 5630 South Ellis Avenue, Chicago, Illinois 60637

Anderson, Carl David, 1938 (13), California Institute of Technology, Pasadena, California 91125

Anderson, Charles Alfred, 1957 (15), Earth Sciences Board, Applied Sciences Building, University of California, Santa Cruz, California 95064

Anderson, Herbert Lawrence, 1960 (13), Enrico Fermi Institute, University of Chicago, 5630 Ellis Avenue, Chicago, Illinois 60637

Anderson, Philip Warren, 1967 (13), Room 1D-26B, Bell Telephone Laboratories, Inc., 600 Mountain Avenue, Murray Hill, New Jersey 07974

Anderson, Theodore Wilbur, 1976 (33), Department of Statistics, Stanford University, Stanford, California 94305

Anderson, Thomas Foxen, 1964 (26), Institute for Cancer Research, 7701 Burholme Avenue, Philadelphia, Pennsylvania 19111

Andrews, Henry Nathaniel, Jr., 1975 (25), Biological Sciences Group, College of Liberal Arts and Sciences U43, University of Connecticut, Storrs, Connecticut 06268

Anfinsen, Christian Boehmer, 1963 (21), Laboratory of Chemical Biology, National Institute of Arthritis, Metabolism, and Digestive Diseases, Building 10, 9N-307, National Institutes of Health, Bethesda, Maryland 20014

Arnold, James Richard, 1964 (16), Department of Chemistry, B-017 University of California, San Diego, La Jolla, California 92093

Arnold, William Archibald, 1962 (25), Biology Division, Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, Tennessee 37830

Arnon, Daniel Israel, 1961 (21), Department of Cell Physiology, Hilgard Hall, University of California, Berkeley, California 94720

Arrow, Kenneth Joseph, 1968 (54), Room 404 Harvard University, 1737 Cambridge Street, Cambridge, Massachusetts 02138

Astin, Allen Varley, 1960 (33), 5008 Battery Lane, Bethesda, Maryland 20014

Atkinson, Richard Chatham, 1974 (52), National Science Foundation, Room 520, 1800 G Street, N.W., Washington, D.C. 20550

Austen, Karl Frank, 1974 (43), Harvard Medical School, Robert B. Brigham Hospital, Parker Hill Avenue, Boston, Massachusetts 02120

MEMBERS

Axelrod, Julius, 1971 (24), National Institute of Mental Health, 9000 Rockville Pike, Building 10, Room 2D-47, Bethesda, Maryland 20014

Aydelotte, William Osgood, 1974 (53), Department of History, University of Iowa, Iowa City, Iowa 52242

Babcock, Horace Welcome, 1954 (12), Hale Observatories, 813 Santa Barbara Street, Pasadena, California 91101

Bacher, Robert Fox, 1947 (13), 405-47, California Institute of Technology, Pasadena, California 91125

Backus, George Edward, 1969 (33), Institute of Geophysics and Planetary Physics, University of California, San Diego, A-025, La Jolla, California 92093

Backus, John, 1974 (33), 91 St. Germain Avenue, San Francisco, California 94114

Bahcall, John Norris, 1976 (12), School of Natural Sciences, The Institute for Advanced Study, Princeton, New Jersey 08540

Bainbridge, Kenneth Tompkins, 1946 (13), Department of Physics, Harvard University, Cambridge, Massachusetts 02138

Baker, James Gilbert, 1965 (12), Harvard College Observatory, Cambridge, Massachusetts 02138

Baker, William Oliver, 1961 (14), Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974

Baldeschwieler, John Dickson, 1970 (14), Division of Chemistry and Chemical Engineering, 164-30, California Institute of Technology, Pasadena, California 91125

Ball, Eric Glendinning, 1948 (21), P.O. Box 406, Falmouth, Massachusetts 02541

Ballou, Clinton Edward, 1975 (21), Department of Biochemistry, University of California, Berkeley, California 94720

Baltimore, David, 1974 (43), Department of Biology, E17-517A, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Bard, Philip, 1944 (23), 502 Vista Hermosa Drive, Ojai, California 93023

Bardeen, John, 1954 (13), Department of Physics, University of Illinois, Urbana, Illinois 61801

Barghoorn, Elso Sterrenberg, 1967 (25), Biological Laboratories, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138

Barker, Horace Albert, 1953 (21), Department of Biochemistry, Biochemistry Building, University of California, Berkeley, California 94720

Barrett, Charles Sanborn, 1967 (31), Denver Research Institute, University of Denver, Denver, Colorado 80210

Barschall, Henry Herman, 1972 (13), Engineering Research Building, University of Wisconsin, Madison, Wisconsin 53706

Bartlett, Paul Doughty, 1947 (14), Department of Chemistry, Texas Christian University, Fort Worth, Texas 76129

Beach, Frank Ambrose, 1949 (52), Department of Psychology, University of California, Berkeley, California 94720

Beadle, George Wells, 1944 (26), 5533 Dorchester Avenue, Chicago, Illinois 60637

Beams, Jesse Wakefield, 1943 (13), Physics Laboratory, McCormick Road, University of Virginia, Charlottesville, Virginia 22903

Bean, Charles Palmer, 1976 (33), General Electric Company, Research and Development Center, Post Office Box 8, Schenectady, New York 12301

Bearn, Alexander Gordon, 1972 (41), Cornell University Medical College, 1300 York Avenue, New York, New York 10021

Becker, Gary Stanley, 1975 (54), Department of Economics, University of Chicago, 1126 East 59th Street, Chicago, Illinois 60637

Beeson, Paul Bruce, 1969 (43), Seattle Veterans Administration Hospital, 4435 Beacon Avenue South, Seattle, Washington 98108

Beevers, Harry, 1969 (25), Division of Natural Sciences, University of California, Santa Cruz, California 95064

Beidler, Lloyd M., 1974 (24), Department of Biological Science, Unit I, Florida State University, Tallahassee, Florida 32306

Benacerraf, Baruj, 1972 (43), Department of Pathology, Harvard Medical School, 25 Shattuck Street, Boston, Massachusetts 02115

Bender, Myron Lee, 1968 (14), Department of Chemistry, Northwestern University, Evanston, Illinois 60201

Benditt, Earl Philip, 1975 (42), Department of Pathology, University of Washington School of Medicine, Seattle, Washington 98195

Benedict, Manson, 1956 (31), Room 24-109, Department of Nuclear Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

MEMBERS

Benson, Andrew Alm, 1973 (25), Scripps Institution of Oceanography, A-002 University of California, San Diego, La Jolla, California 92093

Benzer, Seymour, 1961 (26), Division of Biology, California Institute of Technology, Pasadena, California 91125

Berg, Paul, 1966 (21), Department of Biochemistry, Stanford University School of Medicine, Stanford, California 94305

Berliner, Robert William, 1968 (42), Yale University School of Medicine, 333 Cedar Street, New Haven, Connecticut 06510

Bern, Howard Alan, 1973 (23), Department of Zoology, University of California, Berkeley, California 94720

Bernstein, Richard Barry, 1968 (14), Departments of Chemistry and Physics, University of Texas, Austin, Texas 78712

Berry, Brian Joe Lobley, 1975 (53), Old Tavern Farm 471 Massachusetts Avenue, West Acton, Massachusetts 01720

Bers, Lipman, 1964 (11), Department of Mathematics, Columbia University, New York, New York 10027

Berson, Jerome Abraham, 1970 (14), Department of Chemistry, Yale University, 225 Prospect Street, New Haven, Connecticut 06520

Bethe, Hans Albrecht, 1944 (13), Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14853

Beutler, Ernest, 1976 (41), Division of Medicine, City of Hope National Medical Center, 1500 East Duarte Road, Duarte, California 91010

Bigeleisen, Jacob, 1966 (14), Department of Chemistry, University of Rochester, River Campus, Rochester, New York 14627

Billings, Marland Pratt, 1968 (15), Department of Geological Sciences, Harvard University, 24 Oxford Street, Cambridge, Massachusetts 02138

Bing, R. H., 1965 (11), Department of Mathematics, University of Texas, Austin, Texas 78712

Birch, Albert **Francis,** 1950 (15), Department of Geological Sciences, Harvard University, 24 Oxford Street, Cambridge, Massachusetts 02138

Birge, Raymond Thayer, 1932 (13), 1639 La Vereda, Berkeley, California 94709

Birkhoff, Garrett, 1968 (11), Department of Mathematics, Harvard University, 1 Oxford Street, Cambridge, Massachusetts 02138

Bisplinghoff, Raymond Lewis, 1967 (31), Office of the Chancellor, 210 Parker Hall, University of Missouri, Rolla, Missouri 65401

Bjorken, James Daniel, 1973 (13), Stanford Linear Accelerator Center, Stanford University, P.O. Box 4349, Stanford, California 94305

Blackwell, David Harold, 1965 (11), Department of Statistics, University of California, Berkeley, California 94720

Blalock, Hubert Morse, Jr., 1976 (53) 18425 17th Avenue, N.W., Seattle, Washington 98177

Blinks, Lawrence Rogers, 1955 (25), Hopkins Marine Station of Stanford University, Pacific Grove, California 93950

Bloch, Felix, 1948 (13), Department of Physics, Stanford University, Stanford, California 94305

Bloch, Herman Samuel, 1975 (14), Universal Oil Products, Incorporated, World Headquarters, Ten UOP Plaza, Des Plaines, Illinois 60016

Bloch, Konrad Emil, 1956 (21), Department of Chemistry, Harvard University, 12 Oxford Street, Cambridge, Massachusetts 02138

Bloembergen, Nicolaas, 1960 (13), Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Blout, Elkan Rogers, 1969 (21), Department of Biological Chemistry, Harvard Medical School, Boston, Massachusetts 02115

Blumberg, Baruch Samuel, 1975 (41), Institute for Cancer Research, 7701 Burholme Avenue, Fox Chase, Philadelphia, Pennsylvania 19111

Bochner, Salomon, 1950 (11), Department of Mathematics, Rice University, Houston, Texas 77001

Bode, Hendrik Wade, 1957 (33), Room 321, Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Bodenstein, Dietrich H. F. A., 1958 (22), Department of Biology, Gilmer Hall, University of Virginia, Charlottesville, Virginia 22903

Bodian, David, 1958 (24), Department of Anatomy, Johns Hopkins University School of Medicine, 1721 Madison Street, Baltimore, Maryland 21205

Boekelheide, Virgil Carl, 1962 (14), Department of Chemistry, University of Oregon, Eugene, Oregon 97403

Bogorad, Lawrence, 1971 (25), Biological Laboratories, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138

MEMBERS

Bok, Bart Jan, 1968 (12). Steward Observatory, University of Arizona, Tucson, Arizona 85721

Bold, Harold Charles, 1973 (25). Department of Botany, University of Texas, Austin, Texas 78712

Bonner, James Frederick, 1950 (22). Division of Biology, California Institute of Technology, Pasadena, California 91125

Bonner, John Tyler, 1973 (22). Department of Biology, Princeton University, Princeton, New Jersey 08540

Booker, Henry George, 1960 (16). Department of Applied Physics and Information Science, University of California, San Diego, La Jolla, California 92093

Borchert, John Robert, 1976 (53). Department of Geography, University of Minnesota, Minneapolis, Minnesota 55455

Borlaug, Norman Ernest, 1968 (32). International Maize and Wheat Improvement Center, Londres 40, Mexico 6, D.F., Mexico

Bormann, Frederick Herbert, 1973 (32). Greeley Memorial Laboratory, School of Forestry and Environmental Studies, Yale University, 370 Prospect Street, New Haven, Connecticut 06511

Bose, Raj Chandra, 1976 (11). Department of Mathematics, Colorado State University, Fort Collins, Colorado 80523

Bott, Raoul, 1964 (11). Department of Mathematics, Harvard University, 1 Oxford Street, Cambridge, Massachusetts 02138

Boudart, Michel, 1975 (14) Department of Chemical Engineering, Stanford University, Stanford, California 94305

Boulding, Kenneth Ewart, 1975 (53). Institute of Behavioral Science, University of Colorado, Boulder, Colorado 80309

Bovey, Frank Alden, 1975 (14). Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974

Bower, Gordon Howard, 1973 (52). Department of Psychology, Stanford University, Stanford, California 94305

Boyd, Francis R., Jr., 1974 (15). Geophysical Laboratory, Carnegie Institution of Washington, 2801 Upton Street, N.W., Washington, D.C. 20008

Boyer, Paul Delos, 1970 (21). Molecular Biology Instit[illegible]niversity of California Los Angeles, California 90024

Brace, William Francis, 1971 (15), Room 54-720, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Bradbury, Norris Edwin, 1951 (13), 1451 47th Street, Los Alamos, New Mexico 87544

Brady, Roscoe O., 1975 (21), 9501 Kingsley Avenue, Bethesda, Maryland 20014

Braidwood, Robert John, 1964 (51), RR5, Box 316, La Porte, Indiana 46350

Brakke, Myron Kendall, 1974 (32), Plant Pathology Department, 304 Plant Industry Building, 7U, University of Nebraska, Lincoln, Nebraska 68583

Branscomb, Lewis McAdory, 1970 (33), IBM Corporation, Old Orchard Road, Armonk, New York 10504

Brattain, Walter Houser, 1959 (13), Whitman College, Walla Walla, Washington 99362

Brauer, Richard Dagobert, 1955 (11), Department of Mathematics, Harvard University, 1 Oxford Street, Cambridge, Massachusetts 02138

Brauman, John I., 1976 (14), Department of Chemistry, Stanford University, Stanford, California 94305

Braun, Armin Charles, 1960 (25), Rockefeller University, New York, New York 10021

Braunwald, Eugene, 1974 (42), Harvard Medical School, 25 Shattuck Street, Boston, Massachusetts 02115

Breit, Gregory, 1939 (13), State University of New York at Buffalo, 4248 Ridge Lea Road, Amherst, New York 14226

Breslow, Ronald, 1966 (14), Department of Chemistry, Columbia University, New York, New York 10027

Brewer, Leo, 1959 (14), Department of Chemistry, University of California, Berkeley, California 94720

Briggs, Robert William, 1962 (22), Department of Zoology, Indiana University, Bloomington, Indiana 47401

Briggs, Winslow Russell, 1974 (25), Department of Plant Biology, Carnegie Institution of Washington, 290 Panama Street, Stanford, California 94305

Brink, Frank, Jr., 1959 (24), Rockefeller University, New York, New York 10021

Brink, Royal Alexander, 1947 (26), Department of Genetics, University of Wisconsin, Madison, Wisconsin 53706

MEMBERS

Brinkhous, Kenneth Merle, 1972 (41), Department of Pathology, University of North Carolina School of Medicine, Chapel Hill, North Carolina 27514

Britten, Roy John, 1972 (26), Kerckhoff Marine Laboratory, California Institute of Technology, 101 Dahlia Street, Corona Del Mar, California 92625

Brobeck, John Raymond, 1975 (23), 224 Vassar Avenue, Swarthmore, Pennsylvania 19081

Brode, Robert Bigham, 1949 (13), Department of Physics, University of California, Berkeley, California 94720

Brodie, Bernard Beryl, 1966 (23), 232 Angler Avenue, Palm Beach, Florida 33480

Brooks, Chandler McCuskey, 1975 (23), Department of Physiology, Box 31, State University of New York Downstate Medical Center, 450 Clarkson Avenue, Brooklyn, New York 11203

Brooks, Harvey, 1962 (33), Aiken Computation Laboratory 226, Harvard University, Cambridge, Massachusetts 02138

Browder, Felix Earl, 1973 (11), Department of Mathematics, University of Chicago, 5734 University Avenue, Chicago, Illinois 60637

Brown, Donald David, 1973 (22), Department of Embryology, Carnegie Institution of Washington, 1[illegible]5 West University Parkway, Baltimore, Maryland 21210

Brown, Harrison Scott, 1955 (16), Division of Humanities and Social Sciences, Baxter Hall, California Institute of Technology, Pasadena, California 91125

Brown, Herbert Charles, 1957 (14), Department of Chemistry, Purdue University, Lafayette, Indiana 47907

Brown, Roger William, 1972 (52), Department of Psychology and Social Relations, Harvard University, 33 Kirkland Street, Cambridge, Massachusetts 02138

Brueckner, Keith Allan, 1969 (13), Department of Physics B-019, University of California, San Diego, La Jolla, California 92093

Bruice, Thomas Charles, 1974 (14), Department of Chemistry, University of California, Santa Barbara, California 93106

Bryson, Arthur Earl, **Jr.,** 1973 (31), Department of Aeronautics and Astronautics, Stanford University, Stanford, California 94305

Buchanan, John Machlin, 1962 (21), Room 16-619, Department of Biology, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Buchi, George H., 1965 (14), Room 18-287, Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Buchsbaum, Solomon Jan, 1974 (31), Room 2G-602, Bell Telephone Laboratories Inc., Crawford Corner Road, Holmdel, New Jersey 07733

Budiansky, Bernard, 1973 (33), Division of Engineering and Applied Physics, Harvard University, Cambridge, Massachusetts 02138

Bueche, Arthur Maynard, 1971 (31), Corporate Research and Development, General Electric Company, P.O. Box 8, Schenectady, New York 12301

Buerger, Martin Julian, 1953 (15), Institute of Materials Science, U-136, University of Connecticut, Storrs, Connecticut 06268

Bullock, Theodore Holmes, 1963 (24), Department of Neurosciences, A-001 School of Medicine, University of California, San Diego, La Jolla, California 92093

Burke, Bernard Flood, 1970 (12), Room 26-335, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Burns, John J., 1975 (42), Hoffmann-La Roche Inc., Nutley, New Jersey 07110

Burris, Robert Harza, 1961 (25), Department of Biochemistry, University of Wisconsin, Madison, Wisconsin 53706

Burton, Glenn Willard, 1975 (32), Department of Agronomy, Coastal Plain Station, Experiment Stations, University of Georgia College of Agriculture, Tifton, Georgia 31794

Butler, Warren Lee, 1976 (25), Department of Biology, University of California, San Diego, La Jolla, California 92093

Byerly, Perry, 1946 (16), 5340 Broadway Terrace, #401, Oakland, California 94618

Byers, Horace Robert, 1952 (16), 1036 Fairway, Santa Barbara, California 93108

Cahn, John Werner, 1973 (33), Room 13-5056, Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Cain, Stanley Adair, 1970 (32), Environmental Studies, University of California, Santa Cruz, California 95060

Cairns, Theodore L., 1966 (14), Central Research and Development Department, E. I. du Pont de Nemours & Company, Incorporated, Wilmington, Delaware 19898

Calderón, Alberto Pedro, 1968 (11), Department of Mathematics, University of Chicago, Chicago, Illinois 60601

MEMBERS

Calvin, Melvin, 1954 (14), Laboratory of Chemical Biodynamics, University of California, Berkeley, California 94720

Cameron, Alastair Graham Walter, 1976 (16), Harvard College Observatory, 60 Garden Street, Cambridge, Massachusetts 02138

Campbell, Allan McCulloch, 1971 (26), Department of Biological Sciences, Stanford University, Stanford, California 94305

Campbell, Donald Thomas, 1973 (53), Department of Psychology, Northwestern University, Evanston, Illinois 60201

Cannon, Paul Roberts, 1946 (43), Box 79, Route 2, Yorkville, Illinois 60560

Carrier, George Francis, 1967 (33), Division of Engineering and Applied Physics, Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Carter, Herbert Edmund, 1953 (21), Administration 512-C, University of Arizona, Tucson, Arizona 85721

Case, Kenneth Myron, 1975 (33), Rockefeller University, 1230 York Avenue, New York, New York 10021

Chalmers, Bruce, 1975 (33), Division of Engineering and Applied Physics, Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Chamberlain, Joseph Wyan, 1965 (16), Department of Space Physics and Astronomy, Rice University, Houston, Texas 77001

Chamberlain, Owen, 1960 (13), Lawrence Berkeley Laboratory, 50A/5123, University of California, Berkeley, California 94720

Chance, Britton, 1954 (21), Johnson Research Foundation, Department of Biophysics and Physical Biochemistry, University of Pennsylvania, Philadelphia, Pennsylvania 19174

Chandrasekhar, Subrahmanyan, 1955 (12), Laboratory for Astrophysics and Space Research, 933 East 56th Street, Chicago, Illinois 60637

Chanock, Robert Merritt, 1973 (43), Laboratory of Infectious Diseases, National Institute of Allergy and Infectious Diseases, Building 7, Room 301, National Institutes of Health, Bethesda, Maryland 20014

Chapman, Orville Lamar, 1974 (14), Department of Chemistry, University of California, Los Angeles, California 90024

Chargaff, Erwin, 1965 (21), Cell Chemistry Laboratory, The Roosevelt Hospital, 428 West 59th Street, New York, New York 10019

Charney, Jule Gregory, 1964 (16), Department of Meteorology, 54-1424, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Chase, Merrill Wallace, 1975 (22), Rockefeller University, 1230 York Avenue, New York, New York 10021

Chern, Shiing-shen, 1961 (11), Department of Mathematics, University of California, Berkeley, California 94720

Chew, Geoffrey Foucar, 1962 (13), Department of Physics, University of California, Berkeley, California 94720

Chipman, John, 1955 (33), 19 Lorena Road, Winchester, Massachusetts 01890

Chodorow, Marvin, 1971 (31), Edward L. Ginzton Laboratory, Stanford University, Stanford, California 94305

Chomsky, Avram **Noam,** 1972 (51), Department of Foreign Literatures and Linguistics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Christy, Robert Frederick, 1965 (13), California Institute of Technology, Pasadena, California 91125

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Reichstein, T.
Ruzicka, L.
Sela, M.
Semenov, N. N.
Šorm, F.
Lord T.
Wilkinson, G.

15—*Geology*—41 members

Cloud, P.
Chairman (1979)
Abelson, P. H.
Allen, C. R.
Anderson, C. A.
Billings, M. P.
Birch, F.
Boyd, F. R., Jr.
Brace, W. F.
Buerger, M. J.
Doell, R. R.
Dunbar, C. O.
Emery, K. O.
Engel, A. E. J.
Ernst, W. G.
Eugster, H. P.
Garrels, R. M.
Hedberg, H. D.
Hubbert, M. K.
James, H. L.
Krauskopf, K. B.
Lachenbruch, A. H.
Langbein, W. B.
Leopold, L. B.
Lovering, T. S.
Menard, H. W.
Nolan, T. B.
Patterson, B.
Pettijohn, F. J.
Rodgers, J.
Sharp, R. P.
Silver, L. T.
Simpson, G. G.
Thompson, J. B., Jr.
Turner, F. J.
Tuttle, O. F.
Waters, A. C.
Wells, J. W.
White, D. E.
Williams, H.
Yoder, H. S
Zen, E.

Foreign Associates

Gansser, A.
Goguel, J.
Harrison, J. M.
Ringwood, A. E.
Sander, B.
Wilson, J. T.

16—*Geophysics*—44 members

Munk, W. H.
Chairman (1978)
Anders, E.
Arnold, J. R.
Booker, H. G.
Brown, H.
Byerly, P.
Byers, H. R.
Cameron, A. G. W.
Chamberlain, J. W.
Charney, J. G.
Cox, A.
Elsasser, W. M.
Forbush, S. E.
Fultz, D.
Gilbert F.
Gold, T.
Goldreich, P.
Goody, R. M.
Haurwitz, B.
Helliwell, R. A.
Knopoff, L.
Lorenz, E. N.
MacDonald, G. J. F.
Malkus, W.
Malone, T. F.
Nierenberg, W. A.
Ney, E. P.
Pekeris, C. L.
Phillips, N. A.
Press, F.
Price, P. B.
Reichelderfer, F. W.
Revelle, R.
Reynolds, J. H.
Slichter, L. B.
Stommel, H.
Suess, H. E.
Van Allen, J. A.
Verhoogen, J.
Villard, O. g., Jr.
Walker, R. M.
Wasserburg, G. J.
Wetherill, G. W.
Wulf, O. R.

Foreign Associates

Alfvén, H.
Bullard, Sir E.
Bullen, K. E.
Jeffreys, Sir H.
Keilis-Borok, V. I.
Lal, D.
Monin, A. S.
Nagata, T.
Nicolet, M.
Uyeda, S.

21—*Biochemistry*—117 members

Neurath, H.
Chairman (1978)
Abeles, R. H.
Ames, B. N.
Anfinsen, C. B.
Arnon, D. I.
Ball, E. G.
Ballou, C. E.
Barker, H. A.
Berg, P.
Bloch, K. E.
Blout, E. R.
Boyer, P. D.
Brady, R. O.
Buchanan, J. M.
Carter, H. E.
Chance, B.
Chargaff, E.
Cohen, P. P.
Cohen, S. S.
Cohn, M.
Colowick, S. P.
Cori, C. F.
Davidson, N.
Davis, B. D.
Dische, Z.
Doisy, E. A.
Doty, P.
Edelman, G. M.
Edsall, J. T.
Felsenfeld, G.
Fischer, E. H.
Fraenkel-Conrat, H.
Fruton, J. S.
Geiduschek, E. P.
Gilbert, W.
Granick, S.
Green, D. E.
Gunsalus, I. C.
Handler, P.
Harrington, W. F.
Haurowitz, F.
Heppel, L. A.
Hill, R. L.
Hill, T. L.
Hofmann, K.
Horecker, B. L.
Hurwitz, J.
Jencks, W. P.
Kabat, E. A.
Kalckar, H. M.
Kamen, M. D.
Kaplan, N.
Kennedy, E. P.
Khorana, H. G.
Klotz, I.
Kornberg, A.
Koshland, D. E., Jr.
Krebs, E. G.
Lardy, H.
Lehninger, A. L.
Li, C. H.
Link, K. P.
Lipmann, F.
Lowry, O. H.
Magasanik, B.
Margoliash, E.
McElroy, W. D.
Meister, A.

Merrifield, B.
Meyer, K.
Miller, S. L.
Moore, S.
Morales, M. F.
Nachmansohn, D.
Nirenberg, M. W.
Ochoa, S.
Oncley, J. L.
Pardee, A. B.
Phillips, W. D.
Racker, E.
Ratner, S.
Reed, L. J.
Rich, A.
Richards, F. M.
Rose, W. C.
Roseman, S.
Schachman, H. K.
Schimke, R. T.
Schmidt, G.
Shemin, D.
Shulman, R. G.
Singer, S. J.
Sinsheimer, R. L.
Smith, E. L.
Snell, E. E.
Stadtman, E. R.
Stein, W. H.
Steiner, D. F.
Strominger, J. L.
Sturtevant, J. M.
Szent-Gyorgyi, A.
Tanford, C.
Udenfriend, S.
Umbarger, H. E.
Utter, M. F.
Vagelos, P. R.
Vallee, B. L.
Vickery, H. B.
Wald G.
Watson, J. D.
Weber, G.
White, A.
Williams, R. C.
Williams, R. J.
Wood, H. G.
Wyman, J.
Zamecnik, P. C.

Foreign Associates

Bergström, S.
Braunstein, A. E.
Crick, F.
Engelhardt, W. A.
Hayaishi, O.
Katzir, E.
Kendrew, J. C.
Krebs, Sir H. A.
Leloir, L. F.
Lynen, F.
Perutz, M. F.
Sanger, F.
Theorell, H.

22—*Cellular and Developmental Biology*—41 members

Swift, H. H.
  Chairman (1979)
Bodenstin, D. H.
Bonner, J. F.
Bonner, J. T.
Briggs, R.
Brown, D. D.
Chase, M. W.
Darnell, J. E., Jr.
Dulbecco, R.
Eagle, H.
Ebert, J. D.
Eisen, H. N.
Enders, J. F.
Fawcett, D. W.
Fraenkel, G. S.
Gall, J. G.
Garen, A.
Grobstein, C.
Habel, K.
Hogness, D. S.
Holley, R. W.
Holtfreter, J.
Hotchkiss, R. D.
Koprowski, H.
Markert, C. L.
Mazia, D.
Novikoff, A. B.
Pardee, A. B.
Palade, G. E.
Pappenheimer, A. M., Jr.
Porter, K.
Prescott, D. M.
Puck, T. T.
Ris, H.
Schneiderman, H. A.
Siekevitz, P.
Straus, W. L., Jr.
Trager, W
Weiss, P.
Williams, R. E.
Zirkle, R. E.

Foreign Associates

Beermann, W.
Brachet, J.
Jacob, F.
Lwoff, A.
Medawar, Sir P.
Szentágothai, J.
Wigglesworth, Sir V.

23—*Physiological Sciences*—22 members

Rahn, H.
  Chairman (1977)
Bard, P.
Bern, H. A.
Brobeck, J. R.
Brodie, B. B.
Brooks, C. McC.
Cole, K. S.
Comroe, J. H., Jr.
Cournand, A.
Davenport, H. W.
Forster, R. E.
Gilman, A.
Goodman, L. S.
Hardy, J. D.
Krayer, O.
Landis, E. M.
Pittendrigh, C. S.
Pitts, R. F.
Prosser, C. L.
Schmidt-Nielsen, K.
Scholander, P. F.
Visscher, M. B.

Foreign Associates

Lord Adrian
Best, C. H.
Eccles, Sir J.
Granit, R.
Hill, A. V.
Hodgkin, Sir A.
von Euler, U.S.

24—*Neurobiology*—35 members

Bullock, T. H.
  Chairman (1977)
Axelrod, J.
Beidler, L. M.
Bodian, D.
Brink, F., Jr.
Cohen, M. J.
Davis, H.
Dethier, V. G.
Dowling, J. E.
Evarts, E. V.
Flexner, L. B.
Gajdusek, D. C.
Goebel, W. F.
Griffin, D.
Grundfest, H.
Hamburger, V.
Hartline, H. K.
Hubel, D. H.
Kandel, E. R.
Kennedy, D.
Kety, S. S.
Koelle, G. B.
Kuffler, S. W.
Larrabee, M. G.
Levi-Montalcini, R.
Lorente de Nó, R.
Marler, P.
Mountcastle, V. B.
Nauta, W. J. H.
Roberts, R. B.
Rose, J.
Rosenblith, W. A.
Scharrer, B. V.
Schmitt, F. O.
Woolsey, C. N.

Foreign Associates

Lindauer, M.
Lorenz, K.
Tinbergen, N.
von Frisch, K.

25—*Botany*—37 members

Bogorad, L.
  Chairman (1977)
Andrews, H. N.
Arnold, W. A.
Barghoorn, E. S.
Beevers, H.
Benson, A. A.
Blinks, L. R.
Bold, H. C.
Braun, A. C.
Briggs, W. R.
Burris, R. H.
Butler, W. L.
Couch, J. N.
Emerson, R.
Esau, K.
Evans, H. J.
Fred, E. B.
French, C. S.
Gibbs, M.
Goddard, D. R.
Hendricks, S. B.
Kok, B.
Kramer, P. J.
Lang, A.
Leopold, E. B.
Myers, J.
Patrick, R.
Raper, K. B.
Rollins, R. C.

Skoog, F.
Smith, A. C.
Srb, A. M.
Starr, R. C.
Thimann, K. V.
Van Niel, C. B.
Went, F. W.
Wilson, P. W.

Foreign Associates

Bünning, E.
Frey-Wyssling, A.
Gustafsson, Å.
Hill, R.
Robertson, Sir R. N.
Takhtajan, A.
Tamiya, H.

26—*Genetics*—47 members

Giles, N. H.
Chairman (1979)
Adelberg, E. A.
Anderson, T. F.
Beadle, G. W.
Benzer, S.
Brink, R. A.
Britten, R. J.
Campbell, A. M.
Crow, J. F.
Delbrück, M.
Doermann, A. H.
Emerson, S.
Glass, H. B.
Gorini, L.
Haskins, C. P.
Hershey, A. D.
Hollaender, A.
Horowitz, N. H.
Irwin, M. R.
Kaiser, A. D.
Lederberg, J.
Levinthal, C.
Lewis, E. B.
Lindsley, D. L.
Luria, S. E.
McClintock, B.
Meselson, M. S.
Mintz, B.
Neel, J. V.
Owen, R. D.
Preer, J. R., Jr.
Rhoades, M.M.
Roman, H. L.
Russell, E. S.
Russell, W. L.
Setlow, R. B.
Smithies, O.
Snell, G. D.
Sonneborn, T. M.
Stahl, F. W.
Stern, Curt
Streisinger, G.
Temin, H. M.
Wood, W. B.
Wright, S.
Yanofsky, C.
Zinder, N. D.

Foreign Associates

Auerbach, C.
Catcheside, D. G.
Dubinin, N. P.
Ephrussi, B.
Harris, H.
Kihara, H.
Kimura, M.

27—*Population Biology, Evolution and Ecology*—21 members

Mayr, E.
Chairman (1977)
Alexander, R. D.
Allard, R. W.
Colbert, E. H.
Darlington, P. J., Jr.
Edmondson, W. T.
Eisner, T.
Emerson, A. E.
Friedman, H.
Grant, V.
Hasler, A. D.
Hubbs, C. L.
Hutchinson, G. E.
Lerner, I. M.
Michener, C. D.
Moore, J. A.
Ripley, S. D.
Stebbins, G. L.
Wetmore, A.
Whittaker, R. H.
Wilson, E. O.

Foreign Associate

Slatyer, R. O.

31—*Engineering*—71 members

Pierce, J. R.
Chairman (1978)
Barrett, C. S.
Benedict, M.
Bisplinghoff, R. L.
Bryson, A. E., Jr.
Buchsbaum, S. J.
Bueche, A. M.
Chodorow, M.
Cohen, M.
Collins, S. C.
Curme, G. O., Jr.
Cutler, C. C.
David, E. E., Jr.
Deere, D. U.
Den Hartog, J. P.
Draper, C. S.
Duwez, P.
Edgerton, H. E.
Elias, P.
Emmons, H. W.
Fisk, J. B.
Fletcher, H.
Furth, H. P.
Gilruth, R. R.
Ginzton, E. L.
Goldmark, P. C.
Gould, R. W.
Haensel, V.
Hottel, H. C.
Housner, G. W.
Hunsaker, J. C.
Isaacs, J. D.
Johnson, C. L.
Kinzel, A. B.
Kompfner, R.
Licklider, J. C. R.
Mathews, M. V.
McKay, K. G.
McLean, W. B.
Newmark, N. M.
Oliver, B. M.
Olson, H. F.
Orowan, E.
Patel, C. K. N.
Pearson, G. L.
Pfann, W. G.
Pickering, W. H.
Pigford, R. L.
Piore, E. R.
Puckett, A. .
Quate, C. F.
Ramo, S.
Raymond, A. E.
Schairer, G. S.
Sears, W. R.
Shapiro, A. H.
Shockley, W.
Soderberg, C. R.
Sporn, P.
Stever, H. G.
Stratton, J. A.
Suits, C. G.
Terman, F. E.
Thomas, C. A.
Weber, E.
Whinnery, J. R.
Wiesner, J. B.
Wolman, A.
Wooldridge, D. E.
Zinn, W. H.
Zworykin, V. K.

Foreign Associates

Brun, E. A.
Cottrell, Sir A.
Cousteau, J.
da Rocha, M. C. M.
Esaki, L.
Gabor, D.
Hawthorne, W. R.
Rosenblueth, E.
Roy, M.
Wagner, C.

32—*Applied Biology*—36 members

Scrimshaw, N. S.
Chairman (1978)
Borlaug, N. E.
Bormann, F. H.
Brakke, M. K.
Burton, G. W.
Cain, S.
Cockerham, C. C.
Cowling, E. B.
Cox, G. M.
Darby, W. J.
Davis, G. K.
Harlan, J. R.
Harrar, J. G.
Hegsted, D. M.
Hepting, G. H.
Horsfall, J. G.
Kelman, A.
King, C. G.
Knipling, E. F.
Leopold, A. S.
Lush, J. L.
Mangelsdorf, P. C.
Mertz, E. T.
Metcalf, R. L.
Munro, H. N.
Nelson, O. E., Jr.
Odum, E. P.
Rick, C. M.
Salisbury, G. W.
Schultes, R. E.
Sears, E. R.
Sprague, G. F.
Stakman, E. C.
Stephens, S. G.
Wadleigh, C. H.
Walker, J. C.

Foreign Associates

Glen, R.
Ramalingaswami, V.

33—*Applied Physical and Mathematical Sciences*—59 members

Geballe, T. H.
Chairman (1979)
Anderson, T. W.
Astin, A. V.
Backus, G. E.
Backus, J.
Bean, C. P.
Bode, H. W.
Branscomb, L. M.
Brooks, H.
Budiansky, B.
Cahn, J. W.
Carrier, G. F.
Case, K. M.
Chalmers, B.
Chipman, J.
Clogston, A. M.
Cochran, W. G.
Cole, J. D.
Dantzig, G. B.
Darken, L. S.
Duffin, R. J.
Garabedian, P. R.
Giaever, I.
Goldstine, H. H.
Gomory, R. E.
Gordon, W. E.
Grad, H.
Hagstrum, H. D.
Hansen, M. H.
Harris, Z. S.
John, F.
Kantrowitz, A.
Kaplan, J.
Karlin, S.
Keller, J. B.
Knuth, D. E.
Lax, B.
Liepmann, H. W.
Lin, C. C.
Macdonald, J. R.
Mindlin, R. D.
Minsky, M.
Montroll, E. W.
Mosteller, F.
Mueller, E. W.
Prager, W.
Prausnitz, J. M.
Rosenbluth, M. N.
Schwartz, J. T.
Shull, C. G.
Smith, C. S.
Stoker, J. J.
Thomas, L. H.
Tukey, J. W.
Turnbull, D.
Weaver, W.
Weinberg, A. M.
Zener, C.
Zwanzig, R.

Foreign Associates

Aigrain, P. R.
Casimir, H. B. G.
Jost, R.
Lighthill, Sir M. J.
Lord Penney

41—*Medical Genetics, Hematology, and Oncology*—25 members

Wintrobe, M. M.
Chairman (1977)
Bearn, A. G.
Beutler, E.
Blumberg, B. S.
Brinkhous, K. M.
Cohn, Z. A.
Finch, C. A.
Friend, C.
Furth, J.
Gross, L.
Jacobson, L. O.
Huggins, C. B.
Kaplan, H. S.
Levine, P.
London, I. M.
Marks, P. A.
McKusick, V. A.
Motulsky, A. G.
Nowell, P. C.
Potter, V. R.
Ranney, H. M.
Ratnoff, O D.
Ruddle, F. H.
Spiegelman, S.
Warren, S.

Foreign Associates

de Duve, C.
Klein, G.
Waldenström, J. G.

42—*Medical Physiology, Endocrinology, and Metabolism*—35 members

Dole, V. P.
  Chairman (1979)
Ahrens, E. H., Jr.
Benditt, E. P.
Berliner, R. W.
Braunwald, E.
Burns, J. J.
Clements, J. A.
Conn, J. W.
Cotzias, G. C.
Dorfman, A.
Edelman, I. S.
Fredrickson, D. S.
Goldblatt, H.
Gottschalk, C. W.
Gross, J.
Gross, R. E.
Guillemin, R.
Hastings, A. B.
Hertz, R.
Ingle, D.J.
Isselbacher, K. J.
Jensen, E. V.
Leaf, A.
Lerner, A. B.
Page, I. H.
Popper, H.
Schmid, R.
Seegmiller, J. E.
Shannon, J. A.
Stetten, D., Jr.
Taussig, H. B.
Wangensteen, O. H.
Watson, C. J.
Wyngaarden, J. B.
Yalow, R. S.

Foreign Associates

McMichael, Sir J.
Pickering, Sir G.

43—*Medical Microbiology and Immunology*—34 members

Chanock, R. M.
  Chairman (1977)
Austen, K. F.
Baltimore, D.
Beeson, P. B.
Benacerraf, B.
Cannon, P. R.
Coons, A. H.
Dalldorf, G.
Dixon, F. J.
Finland, M.
Good, R. A.
Heidelberger, M.
Henle, W.
Hirsh, J. G.
Hirst, G. K.
Horstmann, D. M.
Huebner, R. J.
Krugman, S.
Kunkel, H. G.
Lancefield, R. C.
Lawrence, H. S.
McCarty, M.
McDermott, W.
Miller, C. P.
Müller-Eberhard, H. J.
Putnam, F. W.
Rammelkamp, C. H.
Robbins, F. C.
Rowe, W.P.
Sabin, A.B.
Talmage, D. W.
Tamm, I.
Thomas, L.
Weller, T. H.

Foreign Associates

Andrewes, Sir C.
Burnet, Sir M.
Jerne, N. K.
Oudin, J.
Porter, R. R.

51—*Anthropology*—34 members

Griffin, J. B.
  Chairman (1978)
Adams, R. M.
Braidwood, R. J.
Chomsky, N.
Conklin, H. C.
Coon, C. S.
de Laguna, F.
Eggan, F.
Foster, G. McC., Jr.
Garn, S. M.
Geertz, C.
Goodenough, W. H.
Greenberg, J. H.
Haury, E. W.
Heizer, R. F.
Hockett, C. F.
Howell, F. C.
Howells, W. W.
Hulse, F. S.
Krogman, W. M.
Lounsbury, F. G.
MacNeish, R. S.
Mead, M.

Movius, H. L., Jr.
Murdock, G. P.
Rouse, I.
Shapiro, H. L.
Spicer, E. H.
Spoehr, A.
Stewart, T. D.
Wallace, A. F. C.
Washburn, S. L.
Wedel, W. R.
Willey, G. R.

Foreign Associates

Clark, J. G. D.
Lévi-Strauss, C.
Reichel-Dolmatoff, G.
von Konenigswald, G. H. R.

52—Psychology—41 members

Underwood, B. J.
Chairman (1977)
Atkinson, R. C.
Beach, F. A.
Bower, G. H.
Brown, R.
De Valois, R. L.
Estes, W. K.
Festinger, L.
Galambos, R.
Garner, W. R.
Gibson, E. J.
Gibson, J. J.
Guilford, J. P.
Harlow, H. F.
Held, R. M.
Hilgard, E. R.
Hurvich, L.
Jameson, D.
Kluver, H.
Liberman, A. M.
Lindsley, D. B.
Luce, R. D.
Melton, A. W.
Miles, W. R.
Miller, G. A.
Miller, N. E.
Neff, W. D.
Newell, A.
Olds, J.
Pfaffmann, C.
Postman, L. J.
Ratliff, F.
Richter, C. P.
Riggs, L. A.
Skinner, B. F.
Solomon, R. L.
Sperry, R. W.
Stellar, E.
Teitelbaum, P.
Teuber, H. L.
Wever, E. G.

Foreign Associates

Broadbent, D. E.
Luria, A. R.
Milner, B.
Piaget, J.
Sokolov, E. N.

53—Social and Political Sciences—31 members

Merton, R. K.
Chairman (1978)
Aydelotte, W. O.
Berry, B. J. L.
Blalock, H. M., Jr.
Borchert, J. A.
Boulding, K. E.
Campbell, D. T.
Coale, A. J.
Coleman, J. S.
Converse, P. E.
Cronbach, L. J.
Dahl, R. A.
Davis, K.
Deutsch, K. W.
Duncan, O. D.
Freedman, R.
Goodman, L. A.
Hauser, P. M.
Homans, G. C.
Kates, R. W.
Lasswell, H. D.
Lazarsfeld, P. F.
Lipset, S. M.
March, J. G.
Newcomb, T. M.
Osgood, C. E.
Riker, W. H.
Sewell, W. H.
Simon, H. A.
White, G. F.
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Glass, D. V.
Rokkan, S.

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Arrow, K. J.
  Chairman (1977)
Becker, G. S.
Fogel, R. W.
Friedman, M.
Griliches, Z.
Houthakker, H. S.
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Klein, L. R.
Koopmans, T. C.
Kuznets, S.
Leontief, W.
Lerner, A. P.
Marschak, J.
Modigliani, F.
Morgan, J. N.
Radner, R.
Samuelson, P. A.
Scarf, H. E.
Schultz, T. W.
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Haury, E. W.
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Johnson, H. L.
Krayer, O.
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Marvel, C. S.
Mayall, N. U.
Northrop, J. H.
Riker, A. J.
Sears, W. R.
Simpson, G. G.
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Tuttle, O. F.
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Arnon, D. I.
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Bacher, R. F.
Backus, G. E.
Backus, J.
Baldeschwieler, J. D.
Ballou, C. E.
Bard, P.
Barker, H. A.
Beach, F. A.
Beevers, H.
Benson, A. A.
Benzer, S.
Berg, P.
Bern, H. A.
Beutler, E.
Birge, R. T.
Bjorken, J. D.
Blackwell, D.
Bleakney, W.
Blinks, L. R.
Bloch, F.
Bonner, J. F.
Booker, H. G.
Boudart, M.
Bower, G. H.
Boyer, P. D.
Bramlette, M. N.
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Brewer, L.
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Brode, R. B.
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Byers, H. G.
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Calvin, M.
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Chapman, O. L.
Chern, S.
Chew, G. F.
Chodorow, M.
Christy, R. F.
Clements, J. A.
Cloud, P.
Cohen, P. J.
Cole, J. D.
Collman, J. P.
Comroe, J. H., Jr.
Connick, R. E.
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Cram, D. J.
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Dantzig, G. B.
Dauben, W. G.
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Davis, K.
Delbrück, M.
De Valois, R. L.
Dixon, F. J.
Djerassi, C.
Doell, R. R.
Drell, S. D.
DuBridge, L. A.
DuMond, J. W. M.
Duwez, P.
Edelman, I. S.
Emerson, R.
Emerson, S.
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Ernst, W. G.
Esau, K.
Fairbank, W. M.
Feher, G.
Flory, P. J.
Foster, G. McC., Jr.
Fowler, W. A.
Fraenkel-Conrat, H.
French, C. S.
Friedmann, H.
Galambos, R.
Geballe, T. H.
Geiduschek, E. P.
Gell-Mann, M.
Giauque, W. F.
Gilbert, F.
Ginzton, E. L.
Glaser, D. A.
Goldreich, P.
Gould, R. W.
Gray, H. B.
Greenberg, J. H.
Greenstein, J. L.
Grobstein, C.

Guilford, J. P.
Guillemin, R.
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Hahn, E. L.
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Hastings, A. B.
Hawthorne, M. F.
Heizer, R. F.
Helliwell, R. A.
Herbig, G. H.
Hildebrand, J. H.
Hilgard, E. R.
Hille, E.
Hofstadter, R.
Hogness, D. S.
Holley, R. W.
Holm, R. H.
Horowitz, N. H.
Housner, G. W.
Howell, F. C.
Hubbs, C. L.
Isaacs, J. D.
Johnson, C. L.
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Johnston, H. S.
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Kamen, M. D.
Kaplan, H. S.
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Kaplan, N.
Karlin, S.
Kennedy, D.
Kinzel, A. B.
Kittel, C.
Knopoff, L.
Knuth, D. E.
Kohn, W.
Kompfner, R.
Kornberg, A.
Koshland, D. E., Jr.
Kraft, R. P.
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Leighton, R. B.
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Leopold, L. B.
Lerner, I. M.
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Lindsley, D. B.
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Lovering, T. S.
Magoun, H. W.
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March, J. G.
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Matthias, B.
Mayer, J. E.
Mazia, D.
McConnell, H. M.
McElroy, W. D.
McLean, W. B.
McMillan, E. M.
Menard, H. W.
Miller, S. L.
Moore, J. A.
Morales, M.
Morrey, C. B., Jr.
Müller-Eberhard, H. J.
Munch, G.
Munk, W. H.
Neugebauer, G.
Neyman, J.
Nierenberg, W. A.
Olds, J.
Oliver, B. M.
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Owen, R. D.
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Panofsky, W. K. H.
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Pearson, G. L.
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Pickering, W. H.
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Schawlow, A. L.
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Schimke, R. T.
Schmid, R.
Schneiderman, H. A.
Scholander, P. F.
Schwartz, M.
Schwinger, J.
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Seegmiller, J. E.
Segrè, E.
Shane, C. D.
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Shockley, W.
Silver, L. T.
Singer, S. J.
Sinsheimer, R. L.
Slichter, L. B.
Smale, S.
Smith, E. L.
Snell, E. E.
Sperry, R. W.
Stebbins, G. L.
Stein, C. M.
Stern, C.
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Tarski, A.
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Terman, F. E.
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Thomas, T. Y.
Thorne, K. S.
Townes, C. H.
Turner, F. J.
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Verhoogen, J.
Villard, O. G., Jr.
Washburn, S. L.
Wasserburg, G. J.
Waters, A. C.
Watson, K. M.
Webster, D. L.
Wheatley, J. C.
Whinnery, J. R.
White, A.
White, D. E.
Whitford, A. E.
Wilder, R. L.
Williams, H.
Williams, R. C.
Wilson, O. C.
Wood, W. B.
Wooldridge, D. E.
Wulf, O. R.
Yanofsky, C.
Yost, D. M.
Young, W. G.
Zimm, B. H.

Colorado

Barrett, C. S.
Bose, R. C.
Boulding, K. E.
Cohen, S. S.
Cristol, S. J.
Gilluly, J.
Haurwitz, B.
Leopold, E. B.
Porter, K. R.
Prescott, D. M.
Puck, T. T.
Talmage, D. S.
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Zirkle, R. E.

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Bormann, F. H.
Buerger, M. J.
Cohen, M. J.
Conklin, H. C.
Dahl, R. A.
Fixman, M.
Fruton, J. S.
Fuoss, R. M.
Gabor, D.*
Gall, J. G.
Garen, A.
Garner, W. R.
Gilman, A.
Goldmark, P. C.
Hardy, J. D.
Horsfall, J. G.
Horstmann, D. M.
Hughes, V. W.
Hutchinson, G. E.
Jacobson, N.
Koopmans, T. C.
Lasswell, H. D.
Lerner, A. B.
Liberman, A. M.
Lounsbury, F. G.
Markert, C. L.
Mindlin, R. D.
Mostow, G. D.
O'Brien, B.
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Richards, F. M.
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Rouse, I.
Ruddle, F. H.
Scarf, H. E.
Sturtevant, J. M.
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Tobin, J.
Vickery, H. B.
Weaver, W.
Wiberg, K. B.

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Pigford, R. L.
Simmons, H. E.

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Atkinson, R. C.
Boyd, F. R., Jr.
Creutz, E.
Forbush, S. E.
Friedman, H.
Goddard, D. R.
Handler, P.
Haskins, C. P.
Hertz, R.
Herzfeld, K. F.
Hollaender, A.
Hubbert, M. K.
Karle, J.
Miles, W. R.
Nolan, T. B.
Reichelderfer, F. W.
Ripley, S. D.
Roberts, R. B.
Stever, H. G.
Stewart, T. D.
Tousey, R.
Wedel, W. R.
Wetherill, G. W.
Wetmore, A.
Woodring, W. P.
Yoder, H. S., Jr.

Florida

Beidler, L. M.
Brodie, B. B.
Davis, G. K.
Deere, D. U.
Dirac, P. A. M.*
Dunbar, C. O.
Kasha, M.
Onsager, L.
Pitts, R. F.
Schmidt, C. F.

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* Foreign Associate

Slater, J. C.
Ulam, S. M.
Zinn, W. H.

Georgia

Burton, G. W.
Giles, N. H.
Odum, E. P.

Illinois

Adams, R. M.
Anders, E.
Anderson, H. L.
Bardeen, J.
Beadle, G. W.
Becker, G. S.
Bender, M. L.
Bloch, H. S.
Browder, F.
Calderón, A. P.
Campbell, D. T.
Cannon, P.
Chandrasekhar, S.
Closs, G. L.
Coleman, J. S.
Crewe, A. V.
Cronin, J. W.
Curtin, D. Y.
David, E. E., Jr.
Doob, J. L.
Dorfman, A.
Drickamer, H. G.
Eggan, F.
Fano, U.
Flygare, W. H.
Fraenkel, G. S.
Frauenfelder, H.
Fried, J.
Friedman, M.
Fultz, D.
Garrels, R. M.
Goodman, L. A.
Gunsalus, I. C.
Gutowsky, H. S.
Haensel, V.
Harlan, J. R.
Hauser, P. M.
Huggins, C.
Hutchison, C. A., Jr.
Inghram, M. G.
Jacobson, L. O.
Jensen, E. V.
Kaplansky, I.
Katz, J. J.
Klotz, I.
Klüver, H.
Leonard, N. J.
Mac Lane, S.
Marcus, R. A.
Margoliash, E.
Metcalf, R. L.
Miller, C. P.
Mulliken, R. S.
Nambu, Y.
Newmark, N. M.
Osgood, C. E.
Parker, E. N.
Pines, D.
Prosser, C. L.
Rice, S. A.
Rose, W. C.
Sachs, R. G.
Salisbury, G. W.
Schultz, T. W.
Shemin, D.
Simpson, J. A.
Slichter, C. P.
Sprague, G. F.
Steiner, D. F.
Stigler, G. J.
Swan, R. G.
Swift, H. H.
Teitelbaum, P.
Telegdi, V. L.
Turkevich, A. L.
Underwood, B. J.
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Wilson, R. R.
Wolfowitz, J.
Zygmund, A.

Indiana

Braidwood, R. J.
Briggs, R.
Brown, H. C.
Haurowitz, F.
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Mertz, E. T.
Neff, W. D.
Overhauser, A. W.
Preer, J. R., Jr.
Putman, F. W.
Rhoades, M. M.
Shull, H.
Sonneborn, T. M.
Starr, R. C.
Umbarger, H. E.

Iowa

Aydelotte, W. O.
Gilman, H.
Lush, J. L.
Spedding, [illegible]. H.
Van Allen, J. A.

Kansas

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Russell, E. S.
Snell, G. D.

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Axelrod, J.
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Brady, R. O.
Brown, D. D.
Chanock, R. M.
Cole, K. S.
Collins, S. C.
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Ebert, J. D.
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Eugster, H. P.
Evarts, E. V.
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Harrington, W. F.
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Gorini, L.
Griliches, Z.
Gross, J.
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Herschbach, D.
Homans, G. C.
Hornig, D. F.
Hottel, H. C.
Houthakker, H. S.
Howells, W. W.
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Hunsaker, J. C.
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Kuffler, S. W.
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Leaf, A.
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Lorenz, E. N.
Low, F. E.
Luce, R. D.
Luria, S. E.
Mackey, G. W.

MacNeish, R. S.
Magasanik, B.
Malkus, W.
Mayr, E.
Menzel, D. H.
Meselson, M. S.
Minsky, M.
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Morrison, P.
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Mosteller, F.
Movius, H. L., Jr.
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Redfield, A. C.
Revelle, R.
Rich, A.
Roeder, K. D.
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Samuelson, P. A.
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Schmitt, F. O.
Schultes, R. E.
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Segal, I. E.
Shannon, C. E.
Shapiro, A. H.
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Skinner, B. F.
Smith, A. C.
Smith, C. S.
Soderberg, C. R.
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Stone, M. H.
Stratton, J. A.
Street, J. C.
Strominger, J. L.
Szent-Györgyi, A.
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Teuber, H. L.
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Waugh, J. S.
Weinberg, S.
Weisskopf, V. F.
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Westheimer, F. H.
Wetmore, R. H.
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White, H.
Whitehead, G. W.
Wiesner, J. B.
Willey, G. R.
Williams, C. M.
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Wilson, E. O.
Woodward, R. B.
Zacharias, J. R.
Zamecnik, P. C.
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Alexander, R. D.
Conn, J. W.
Converse, P. E.
Crane, H. R.
Davenport, H. W.
Elderfield, R. C.
Freedman, R.
Garn, S. M.
Griffin, J. B.
Ingle, D. J.
Lang, A.
Morgan, J. N.
Neel, J. V.
Newcomb, T. M.
Oncley, J. L.

Minnesota

Borchert, J. R.
Crawford, B., Jr.
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Kolthoff, I. M.
Luyten, W. J.
Ney, E. P.
Nier, A. O. C.
Stakman, E. C.
Visscher, M. B.
Wangensteen, O. H.
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Doisy, E. A.
Feenberg, E.
Hamburger, V.
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Lowry, O. H.
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Baker, W. O.
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Buchsbaum, S. J.
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Clogston, A. M.
Coale, A. J.
Cutler, C. C.
Dicke, R. H.
Dyson, F. J.
Fisk, J. B.
Fitch, V. L.
Furth, H. P.
Geertz, C.
Gödel, K.
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Hagstrum, H. D.
Hammett, L. P.
Hedberg, H. D.
Herring, C.
Hopfield, J. J.
Horecker, B. L.
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Levine, P.
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McDermott, W.
McKay, K. G.
Milnor, J. W.
Mislow, K.
Montgomery, D.
Morse, M.
Ochoa, S.
Olson, H. F.
Ostriker, J. P.
Patel, C. K. N.
Penzias, A. A.
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Rosenbluth, M. N.
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Stein, E. M.
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Tukey, J. W.
Udenfriend, S.
Vagelos, P. R.
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New Mexico

Bradbury, N. E.
Livingston, M. S.
Zachariasen, W. H.

New York

Ahrens, E. H., Jr.
Bean, C. P.
Bearn, A. G.
Bers, L.
Bethe, H. A.
Bigeleisen, J.
Blomquist, A. T.
Branscomb, L. M.
Braun, A. C.
Breit, G.
Breslow, R.
Brink, F., Jr.
Brooks, C. McM.
Bueche, A. M.
Chargaff, E.
Case, K. M.
Chase, M. W.
Cohn, Z. A.
Conant, J. B.
Cool, R. L.
Cotzias, G. C.
Courant, E. D.
Cournand, A.
Darby, W. J.
Darnell, J. E., Jr.
Dische, Z.
Dole, V. P.
Drake, F. D.
Dubos, R.
du Vigneaud, V.
Eagle, H.
Eccles, Sir J.*
Edelman, G. M.
Eilenberg, S.
Eisner, T.
Emerson, A. E.
Esaki, L.*
Estes, W. K.
Festinger, L.
Friedlander, G.
Friedrichs, K. O.
Friend, C.
Furth, J.
Garabedian, P.
Garwin, R. L.
Gates, M.
Giaever, I.
Gibson, E. J.
Gibson, J. J.
Glass, H. B.
Goebel, W. F.
Gold, T.
Goldhaber, G. S.
Goldhaber, M.
Goldstine, H. H.
Gomory, R. E.
Good, R. A.
Grad, H.
Granick, S.
Greisen, K. I.
Griffin, D. R.
Gross, L.
Grundfest, H.
Hammes, G. G.
Harrar, J. G.
Hartline, H. K.
Haworth, L. J.
Heidelberger, M.
Heppel, L. A.
Hershey, A. D.
Hirsch, J. G.
Hirst, G. K.
Hoard, J. L.
Hockett, C. F.
Hoffmann, R.
Holtfreter, J.
Hotchkiss, R. D.
Huizenga, J. R.
Hurwitz, J.

* Foreign Associate

John, F.
Kabat, E. A.
Kac, M.
Kandel, E. R.
Keller, J. B.
Kiefer, J. C.
Krugman, S.
Kunkel, H. G.
Lancefield, R.
Lawrence, H. S.
Lax, P. D.
Lederman, L. M.
Lee, T. D.
Leontief, W.
Lerner, A. P.
Levinthal, C.
Lipmann, F.
Long, F. A.
Longsworth, L. G.
Luttinger, J. M.
Mark, H. F.
Marks, P. A.
Marler, P.
Marshak, R. E.
McCarty, M.
McClintock, B.
Mead, M.
Meinwald, J.
Meister, A.
Merrifield, B.
Merton, R. K.
Meyer, K.
Miller, G. A.
Miller, N. E.
Montroll, E. W.
Moore, S.
Moser, J.
Muetterties, E. L.
Nachmansohn, D.
Nirenberg, L.
Novikoff, A. B.
Pais, A.
Pfaffmann, C.
Piore, E. R.
Popper, H.
Rabi, I. I.
Racker, E.
Rahn, H.
Rainwater, L. J.
Ratliff, F.
Ratner, S.
Riker, W. H.
Robbins, H.
Robbins, W. J.
Ruderman, M. A.
Salpeter, E. E.
Scharrer, B.
Scheraga, H. A.
Schwartz, J. T.
Seitz, F.
Serber, R.
Setlow, R. B.
Shapiro, H. L.
Shedlovsky, T.
Siekevitz, P.
Smith, P. A.
Sorokin, P. P.
Spiegelman, S.
Sporn, P.
Srb, A. M.
Stein, W. H.
Stoker, J. J.
Stork, G.
Suits, C. G.
Tamm, I.
Thomas, L.
Trager, W.
Uhlenbeck, G. E.
Watson, J. D.
Weiss, P.
Wells, J. W.
Whittaker, R. H.
Wick, G. C.
Widom, B.
Wilson, K. G.
Wu, C. S.
Yalow, R. S.
Yang, C. N.
Zare, R. N.
Zinder, N. D.

North Carolina

Brinkhous, K. M.
Cockerham, C. C.
Couch, J. N.
Cowling, E. B.
Cox, G. M.
Eliel, E. L.
Gordy, W.
Gottschalk, C. W.
Hepting, G. H.
Hill, R. L.
Hoeffding, W.
Kramer, P. J.
Macdonald, J. R.
Mangelsdorf, P. C.
Parr, R. G.
Rice, O. K.
Schmidt-Nielsen, K.
Stephens, S. G.
Tanford, C.
Thomas, L. H.
Weber, E.
Wyngaarden, J. B.

Ohio

Goldblatt, H.
Herget, P.
Newman, M. S.
Olah, G. A.
Page, I. H.
Rammelkamp, C. H.
Ratnoff, O. D.
Robbins, F. C.
Utter, M. F.
Wood, H. G.

Oregon

Boekelheide, V.
Emmett, P. H.
Evans, H. J.
Stahl, F. W.
Streisinger, G.

Pennsylvania

Anderson, T. F.
Blumberg, B. S.
Brobeck, J. R.
Chance, B.
Cohn, M.
Corner, G. W.
Darken, L. S.

de Laguna, F.
Duffin, R. J.
Flexner, L. B.
Forster, R. E.
Goodenough, W. H.
Habel, K.
Harris, H.*
Harris, Z. S.
Henle, W.
Hofmann, K.
Hurvich, L. M.
Jameson, D.
King, C. G.
Klein, L. R.
Koelle, G. B.
Koprowski, H.
Krogman, W. M.
Kunitz, M.
Landis, E. M.
Lazarsfeld, P. F.
Long, E. R.
Mintz, B.
Mueller, E. W.
Murdock, G. P.
Newell, A.
Nowell, P. C.
Patrick, R.
Primakoff, H.
Schreiffer, J. R.
Simon, H. A.
Solomon, R. L.
Spoehr, A.
Stellar, E.
Wallace, A. F. C.
Warner, J. C.
Zener, C.

Rhode Island

Cooper, L. N.
Federer, H.
Riggs, L. A.

South Carolina

Sabin, A. B.

Tennessee

Arnold, W. A.
Colowick, S. P.
Russell, W. L.
Tarbell, D. S.
Weinberg, A. M.

Texas

Bartlett, P. D.
Bernstein, R. B.
Bing, R. H.
Bochner, S.
Bold, H. C.
Chamberlain, J. W.
Cotton, F. A.
Folkers, K.
Gilruth, R. R.
Gordon, W. E.
Grant, V.
Hackerman, N.
Kusch, P.
Margrave, J. L.
Melton, A. W.
Myers, J.
Noyes, W. A., Jr.
Pettit, R.
Reed, L. J.
Rossini, F. D.
Wall, F. T.
Wheeler, J. A.
Williams, R. J.

Utah

Eyring, H.
Fletcher, H.
Goodman, L. S.
Walling, C.
Wintrobe, M. M.

Vermont

Gross, R. E.
Johnson, J. R.

Virginia

Beams, J. W.
Bodenstein, D. H.
Burns, R. K.
Curme, G. O., Jr.
Heeschen, D. S.
Knipling, E. F.
Langbein, W. B.
McShane, E. J.
Zen, E.

Washington

Beeson, P. B.
Benditt, E. P.
Blalock, H. M., Jr.
Brattain, W. H.
Doermann, A. H.
Edmondson, W. T.
Finch, C. A.
Fischer, E. H.
James, H. L.
Motulsky, A. G.
Neurath, H.
Roman, H. L.
Schairer, G. S.

West Virginia

Kellermann, K. I.

Wisconsin

Barschall, H. H.
Brink, R. A.
Burris, R. H.
Code, A. D.
Cohen, P. P.
Crow, J. F.
Ferry, J. D.
Fred, E. B.
Green, D. E.
Hasler, A. D.
Herb, R. G.
Hirschfelder, J. O.
Irwin, M. R.
Kelman, A.

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* Foreign Associate

Kerst, D. W.
Kleene, S. C.
Kraushaar, W. L.
Lardy, H.
Link, K. P.
Morgan, W. W.
Nelson, O. E., Jr.
Potter, V. R.
Raper, K. B.
Ris, H.
Rose, J. E.
Sewell, W. H.
Skoog, F.
Smithies, O.
Temin, H. M.
Williams, J. W.
Wilson, P. W.
Woolsey, C. N.
Wright, S.

Members Abroad

England—

Dulbecco, R.
Lloyd, D. P. C.
Phillips, W. D.
Thompson, J. G.

Israel—

Pekeris, C. L.
Perlman, I.

Italy—

Wyman, J.

Mexico—

Borlaug, N. E.

Switzerland—

Prager, W.
Steinberger, J.
Wentzel, G.

STANDING COMMITTEES OF THE ACADEMY (JULY 1, 1976)

Auditing

Caryl P. Haskin, *chairman;* H. S. Yoder, Roy Hertz.

BIOGRAPHICAL MEMOIRS

David R. Goddard, *chairman*, ex officio, Home Secretary of the Academy.

Finance

E. R. Piore, *chairman*, ex officio, Treasurer of the Academy.
Philip Handler, ex officio, President of the Academy.
Philip H. Abelson (1978), William O. Baker (1976), Maclyn McCarty (1980).
Franco Modigliani (1976), Philip Sporn (1978), J. A. Stratton (1980).

Editorial Board of the Proceedings

Robert L. Sinsheimer, Chairman.
Robert M. Solow, Vice Chairman.
Michael Kasha, Vice Chairman.
David R. Goddard, Home Secretary.
George S. Hammond, Foreign Secretary.
E. R. Piore, Treasurer.
Alexander G. Bearn, P. D. Boyer, Kingsley Davis, Harry Eagle, Herman Eisen, Mark Kac, Martin D. Kamen, Henry S. Kaplan, Seymour S. Kety, Maclyn McCarty, Eugene P. Odum, Alexander Rich, Paul A. Samuelson, E. R. Stadtman, Howard M. Temin.

Retirement Annuity Program

Pension Committee: Philip Handler, President of the Academy; E. R. Piore, Treasurer of the Academy; David R. Goddard, Home Secretary of the Academy.
Trustees: Philip Handler, B. L. Kropp.

TRUST FUND AND AWARD COMMITTEES

(As of July 1, 1976)

Where incomplete committees are indicated no presentation was made in 1976. Additional members will be sought well in advance of the next scheduled award.

Henryk Arctowski Fund

Gold medal and honorarium, for the promotion of the study of solar activity changes of short or long duration and their effects upon the ionosphere and terrestrial atmosphere
Committee: James G. Baker (1976), William L. Kraushaar (1978), Edward P. Ney (1978).

ARCTOWSKI MEDALISTS

Parker, Eugene Norman, 1969
Wild, J. Paul, 1969
Johnson, Francis Severin, 1972
Beckers, Jacques M., 1975

Alexander Dalles Bache Fund

Grants for researches in physical and natural science
Board of Directors: Donald R. Griffin, *Chairman;* J. T. Bonner, Joseph L. Doob, Konrad B. Krauskopf.

John J. Carty Fund

Gold medal and honorarium, awarded not oftener than every two years, for noteworthy and distinguished accomplishment in any field of science coming within the scope of the charter of the Academy

Committee: William A. Nierenberg, *Chairman* (1977); Sterling Hendricks (1977), Bernhard Witkop (1978).

JOHN J. CARTY MEDALISTS

Carty, John J., 1932
Wilson, Edmund Beecher, 1936
Bragg, Sir William, 1939
Conklin, Edwin Grant, 1943
Durand, William Frederick, 1945
Harrison, Ross Granville, 1947
Langmuir, Irving, 1950
Bush, Vannevar, 1953
Townes, Charles Hard, 1961
Ewing, Maurice, 1963
Sturtevant, Alfred Henry, 1965
Gell-Mann, Murray, 1968
Watson, James Dewey, 1971
Wilson, J. Tuzo, 1975

Cyrus B. Comstock Fund

Prize awarded every five years for most important discovery or investigation in electricity, magnetism, or radiant energy, or to aid worthy investigation in those subjects.

Committee: since no presentation of this award is planned until 1978 the membership of the Award Committee is not being brought up to date at this time. A Chairman and additional members will be named well in advance of the next scheduled award.

COMSTOCK PRIZE AWARDEES

Millikan, Robert A., 1913
Barnett, Samuel J., 1918
Duane, William, 1923
Davisson, C. J., 1928
Bridgman, Percy W., 1933
Lawrence, Ernest O., 1938
Kerst, Donald W., 1943
Tuve, Merle A., 1948
Shockley, William, 1953
Townes, Charles Hard, 1958
Wu, Chien-Shiung, 1963
Cooper, Leon N., 1968
Schrieffer, J. Robert, 1968
Dicke, Robert H., 1973

Arthur L. Day Fund

To advance studies of the physics of the earth

Trust Fund Committee: Merle A. Tuve, *Chairman* (1977); Herbert Friedman (1976), John H. Reynolds (1976), J. A. Van Allen (1977).

Selection Committee: George W. Wetherill (1977).

ARTHUR L. DAY PRIZE AWARDEES

Yoder, Hatten S., 1972
Matthews, Drummond H., 1975
Vine, Fred J., 1975*

Henry Draper Fund

Gold medal, awarded not more often than once every two years, for notable investigation in astronomical physics

Committee: Kip S. Thorne, *Chairman* (1978); S. Chandrasekhar (1978), E. E. Salpeter (1978), Richard Tousey (1978).

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*Joint Award.

HENRY DRAPER MEDALISTS

Langley, Samuel P., 1886
Pickering, E. C., 1888
Rowland, H. A., 1890
Vogel, H. K., 1893
Keeler, J. E., 1899
Huggins, Sir William, 1901
Hale, George E., 1904
Campbell, W. W., 1906
Abbot, C. G., 1910
Deslandres, H., 1913
Stebbins, Joel, 1915
Michelson, A. A., 1916
Adams, W. S., 1918
Fabry, Charles, 1919
Fowler, Alfred, 1920
Zeeman, Pieter, 1921
Russell, Henry Norris, 1922
Eddington, Sir Arthur Stanley, 1924
Shapley, Harlow, 1926
Wright, William Hammond, 1928
Cannon, Annie Jump, 1931
Slipher, V. M., 1932
Plaskett, John Stanley, 1934
Mees, C. E. Kenneth, 1936
Wood, Robert Williams, 1940
Bowen, Ira Sprague, 1942
Merrill, Paul W., 1945
Bethe, Hans Albrecht, 1947
Struve, Otto, 1949
Lyot, Bernard, 1951
van de Hulst, Hendrik C., 1955
Babcock, Horace W., 1957
Schwarzschild, Martin, 1960
Tousey, Richard, 1963
Ryle, Martin, 1965
Edlén, Bengt, 1968
Chandresekhar, Subrahmanyan, 1971
Spitzer, Lyman, Jr., 1974

Daniel Giraud Elliot Fund

Gold medal and honorarium, for the most meritorious work in zoology or paleontology published each year

Committee: John W. Wells, *Chairman,* Richard D. Alexander (1977), John A. Moore (1978), Wendell P. Woodring (1978).

DANIEL GIRAUD ELLIOT MEDALISTS

Chapman, F. M., 1917
Beebe, William, 1918
Ridgway, Robert, 1919
Abel, Othenio, 1920
Dean, Bashford, 1921
Wheeler, William Morton, 1922
Canu, Ferdinand, 1923
Breuil, Henri, 1924
Wilson, Edmund B., 1925
Stensiö, Erik A.: Son, 1927
Seton, Ernest Thompson, 1928
Osborn, Henry Fairfield, 1929
Coghill, George Ellett, 1930
Black, Davidson, 1931
Chapin, James P., 1932
Lull, Richard Swann, 1933
Painter, Theophilus Shickel, 1934
Colbert, Edwin H., 1935
Murphy, Robert Cushman, 1936
Parker, George Howard, 1937
Irwin, Malcolm Robert, 1938
Northrop, John Howard, 1939
Scott, William Berryman, 1940
Dobzhansky, Theodosius, 1941
Thompson, Sir D'Arcy W., 1942
Lashley, Karl Spencer, 1943
Simpson, George Gaylord, 1944
Wright, Sewall Green, 1945
Broom, Robert, 1946
Patterson, John Thomas, 1947
Bigelow, Henry B., 1948
Bent, Arthur Cleveland, 1949
Osburn, Raymond Carrol, 1950
Hyman, Libbie Henrietta, 1951
Carr, Archie Fairly, 1952
Ekman, Sven P., 1953
Friedmann, Herbert, 1955
Rober, Alfred Sherwood, 1956
Darlington, Philip J., Jr., 1957
Griffin, Donald Redfield, 1958
Simpson, George Gaylord, 1965
Mayr, Ernst, 1967
Alexander, Richard, 1971
Evans, Howard Ensign, 1976

GIBBS BROTHERS FUND

Gold medal and honoriarum awarded not more often than once every two years, for outstanding contribution in the field of naval architecture and marine engineering

Committee: N. M. Newmark, *Chairman* (1977); Philip Eisenberg (1978), Alfred H. Keil (1978), Nathan Sonenshein (1978).

GIBBS BROTHERS MEDALISTS

Todd, Frederick Henry, 1965
Kiel, Alfred Adolf Heinrich, 1967
Schade, Henry A., 1971
Eisenberg, Phillip, 1974
Niedermair, John Charles, 1976

WOLCOTT GIBBS FUND

Grants for chemical research

Board of Directors: Bryce Crawford, Jr., *Chairman,* James S. Coles, George S. Hammond, W. H. Stockmayer.

BENJAMIN APTHORP GOULD FUND

Honorarium awarded for outstanding contribution in astronomy, the mechanics of orbits of asteroids or comets or problems of local galactic structure

Board of Directors: Fred L. Whipple, *Chairman,* William A. Fowler, Herbert Friedman, D. S. Heeschen.

GOULD PRIZE AWARDEES

Roemer, Elizabeth, 1971
Kellermann, Kenneth I., 1973
Woltjer, Lodewijk, 1975

JOSEPH HENRY FUND

Grants to assist meritorious investigators, especially in the direction of original research

Committee: Murray Gell-Mann *Chairman* (1975); Jerrold Meinwald (1978), Arthur Pardee (1978), Waldo R. Wedel (1975).

HUNSAKER FUND

The National Academy of Sciences Award in Aeronautical Engineering consists of an honorarium awarded every five years; established by a gift of Mr. and Mrs. J. C. Hunsaker.

Committee: Raymond L. Bisplinghoff (1978). Since no presentation of the award is planned for 1976, the membership of the Award Committee is not being brought up to date at this time. Additional members will be named well in advance of the next scheduled award.

NAS AWARD IN AERONAUTICAL ENGINEERING

Grumman, Leroy Randle, 1968
Douglas, Donald Wills, Sr., 1973

KIMBER GENETICS AWARD (Inactive since 1967)

Gold Medal and honorarium awarded from time to time for achievement in the science of genetics; established as an international award by John Kimber

KIMBER GENETICS MEDALISTS

Castle, William Ernest, 1955
Muller, Hermann Joseph, 1955
Wright, Sewall Green, 1956
Sturtevant, A. H., 1957
Dobzhansky, Theodosius, 1958
Sonneborn, Tracy Morton, 1959
Beadle, George W., 1960
Haldane, John Burdon Sanderson, 1961
Demerec, Milislav, 1962
Stern, Curt, 1963
Delbrück, Max, 1964
Hershey, Alfred Day, 1965
Timofeeff-Ressovsky, Nikolai V., 1966
McClintock, Barbara, 1967

Jessie Stevenson Kovalenko Fund

Gold medal and honorarium for meritorious research in medical science
Committee: Irvine H. Page, *Chairman* (1976); Seymour S. Kety (1976), Helen M. Ranney (1978), James A. Shannon (1978).

KOVALENKO MEDALISTS

Richard, Alfred Newton, 1952
Rous, Peyton, 1955
Goodpasture, Ernest W., 1958
Opie, Eugene Lindsay, 1959
Meyer, Karl Fredrich, 1961
Whipple, George Hoyt, 1962
Cole, Rufus, 1966
Link, Karl Paul, 1967
Francis, Thomas, Jr., 1970 (p.h.)
Kety, Seymour Solomon, 1973
Comroe, Julius Hiram, Jr., 1976

Marsh Fund

Grants for original research in the natural sciences
Committee: John D. Baldeschwieler, *Chairman* (1976); Clifford Grobstein (1977), James D. Hardy (1975), Konrad B. Krauskopf, (1977).

George P. Merrill Fund

Grants for studies of meteors, meteorites, and space
Committee: F. D. Drake, *Chairman* (1976); Josehp W. Chamberlain (1977), Robert H. Dicke (1978), Riccardo Giacconi (1978).

Murray Fund

Agassiz gold medal for original contribution in the science of oceanography
Committee: Roger Revelle, *Chairman* (1978); Jule Charney (1978), K. O. Emery (1978), Robert M. Garrels (1978).

AGASSIZ MEDALISTS

Hjort, Johan, 1913
Albert I, Prince of Monaco, 1918
Sigsbee, Charles Dwight, 1920
Pettersson, Otto Sven, 1924
Bjerknes, Wilhelm, 1926
Weber, Max, 1927
Ekman, Vagn, Walfrid, 1928
Gardiner, J. Stanley, 1929
Schmidt, Johannes, 1930
Bigelow, Henry Bryant, 1931
Defant, Albert, 1932
Helland-Hansen, Björn, 1933
Gran, Haakon Hasberg, 1934
Vaughan, T. Wayland, 1935
Knudsen, Martin, 1936
Allen, Edgar Johnson, 1937
Sverdrup, Harald Ulrik, 1938
Lillie, Frank Rattray, 1939
Iselin II, Columbus, 1942
Proudman, Joseph, 1946
Vening Meinesz, Felix Andries, 1947
Thompson, Thomas Gordon, 1948
Marmer, Harry A., 1951
Harvey, H. W., 1952
Ewing, Maurice, 1954
Redfield, Alfred Clarence, 1955
Johnson, Martin Wiggo, 1959
Bruun, Anton Frederik, 1960
Deacon, George Edward Raven, 1962
Revelle, Roger R. 1963
Bullard, Sir Edward, 1965
Eckart, Carl, 1966
Fuglister, Frederick C., 1969
Uyeda, Seiya, 1972
Steele, John H., 1973
Munk, Walter Heinrich, 1976

National Academy of Sciences Award in Applied Mathematics and Numerical Analysis

Honorarium, awarded once every three years through funds provided by the International Business Machines Corporation
Committee: Samuel Karlin, *Chairman* (1978); Ralph E. Gomory (1978), Mark Kac (1978), Elliott Montroll (1976).

NAS AWARD IN APPLIED MATHEMATICS AND NUMERICAL ANALYSIS

Friedrichs, Kurt Otto, 1972
Karlin, Samuel, 1973

National Academy of Sciences Award in Environmental Quality

Honorarium awarded in recognition of significant contributions to environmental quality presented annually through funds provided by Research Corporation in honor of Frederick Gardner Cottrell

Committee: Franklin A. Long, *Chairman* (1976); W. T. Edmondson (1976), Arie J. Haagen-Smit (1977), Estella Bergere Leopold (1978), Gordon J. F. MacDonald (1976)

NAS AWARD IN ENVIRONMENTAL QUALITY

Haagen-Smit, Arie Jan, 1972
Edmondson, W. Thomas, 1973
Hutchinson, G. Evelyn, 1974
Middleton, John T., 1975
Evans, David M., 1976

Public Welfare Medal

Gold medal and honorarium, for eminence in the application of science to the public welfare, established by the Marcellus Hartley Fund now depleted

Council Committee on National Science Policy: Kenneth S. Pitzer, *Chairman*; C. B Anfisen (1977), George S. Hammond (1978), Roger Revelle (1977).

PUBLIC WELFARE MEDALISTS

Goethals, G. W., 1914
Gorgas, W. C., 1914
Abbe, Cleveland, 1916
Pinchot, Gifford, 1916
Stratton, S. W., 1917
Hoover, Herbert, 1920
Stiles, C. W., 1921
Chapin, Charles V., 1928
Mather, Stephen Tyng, 1930
Rose, Wickliffe, 1931
Park, William Hallock, 1932
Fairchild, David, 1933
Vollmer, August, 1934
Russel, F. F., 1935
Cumming, Hugh S., 1935
Whitney, Willis Rodney, 1937
Hoover, John Edgar, 1939
Rockefeller, John D., Jr., 1943
Bush, Vannevar, 1945
Compton, Karl Taylor, 1947
Shull, George Harrison, 1948
Lilienthal, David E., 1951
Killian, James R., Jr., 1956
Weaver, Warren, 1957
Moe, Henry Allen, 1958
Doolittle, James H., 1959
Waterman, Alan T., 1960
Shannon, James A., 1962
Harrar, J. George, 1963
Bronk, Detlev Wulf, 1964
Gardner, John W., 1966
Hill, Lister, 1969
Carmichael, Leonard, 1972
Daddario, Emilio Q., 1976

H. P. Robertson Memorial Lectureship Fund

To provide an honorarium for a lecture once every three years by a distinguished scientist from any part of the world

Committee: George S. Hammond (1978), Kip S. Thorne.

H. P. ROBERTSON LECTURERS

Wheeler, John A., 1967
Doty, Paul, 1971
Rees, Martin, 1975

J. Lawrence Smith Fund

Gold medal, awarded not more often than once every two years, and grants for investigations of meteoric bodies

Committee: G. J. Wasserburg, *Chairman* (1976); Edward Anders (1978), Melvin Calvin (1978), Walter M. Elsasser (1978).

J. LAWRENCE SMITH MEDALISTS

Newton, H. A., 1888
Merrill, George P., 1922
Perry, Stuart Hoffman, 1945
Whipple, Fred Lawrence, 1949
Millman, Peter Mackenzie, 1954
Inghram, Mark G., 1957
Öpik, Ernst J., 1960
Urey, Harold Clayton, 1962
Reynolds, John Hamilton, 1967
Henderson, Edward Porter, 1970
Anders, Edward, 1971
Patterson, Clair Cameron, 1973
Wood, John Armstead, 1976

MARY CLARK THOMPSON FUND

Gold medal for most important service to geology and paleontology

MARY CLARK THOMPSON MEDALISTS

Walcott, Charles Doolittle, 1921
Margerie, Emmanuel de, 1923
Clarke, John Mason, 1925
Smith, James Perrin, 1928
Scott, William Berryman, 1930
Ulrich, Edward Oscar, 1930
White, David, 1931
Bather, Francis Arthur, 1932
Schuchert, Charles, 1934
Grabua, Amadeus William, 1936
Watson, David Meredith Seares, 1941
Woodward, Sir Arthur Smith, 1942
Berry, Edward Wilber, 1942
Simpson, George Gaylord, 1943
Arkell, William Joscelyn, 1944
Vaughan, T. Wayland, 1945
Reeside, John Bernard, Jr., 1946
McLearn, Frank, 1948
Koch, Lauge, 1949
Stephenson, Lloyd William, 1952
Romer, Alfred Sherwood, 1954
Cooper, Gustav Arthur, 1957
Kozlowski, Roman, 1958
Newell, Norman Dennis, 1961
Bramlette, Milton Nunn, 1964
Woodring, Wendell Phillips, 1967
Moore, Raymond Cecil, 1970
Hedberg, Hollis Dow, 1973
Schopf, James Morton, 1976

U.S. STEEL FOUNDATION AWARD IN MOLECULAR BIOLOGY

Honorarium, may be presented annually, for recent notable discovery in this field by a young scientist

Committee: Donald D. Brown, *Chairman* (1976); Marshal Warren Nirenberg (1978) Charles Yanofsky (1977).

AWARDS IN MOLECULAR BIOLOGY

Nirenberg, Marshall W., 1962
Meselson, Matthew S., 1963
Yanofsky, Charles, 1964
Edgar, Robert Stuart, 1965
Zinder, Norton D., 1966
Holley, Robert W., 1967
Gilbert, Walter, 1968
Wood III, William Barry, 1969
Kaiser, Armin Dale, 1970
Nomura, Masayasu, 1971
Temin, Howard Martin, 1972
Brown, Donald David, 1973
Baltimore, David, 1974
Alberts, Bruce M., 1975
Nathans, Daniel, 1976

SELMAN A. WAKSMAN AWARD IN MICROBIOLOGY

Honorarium awarded annually or biennially in honor of Selman A. Waksman; the award is made available by the Foundation for Microbiology

Committee: Rollin D. Hotchkiss (1976).

WAKSMAN AWARDEES

Strominger, Jack L., 1968
Stadtman, Earl Reece, 1970
Yanofsky, Charles, 1972
Dulbecco, Renato, 1974
Rowe, Wallace Prescott, 1976

Charles Doolittle Walcott Fund

For stimulation of research in pre-Cambrian or Cambrian life by award of a gold medal and honorarium every five years

Board of trustees: Ernst Mayr, *Chairman* (1976); Albert E. Engel (1977), Kenneth V. Thimann (1978), Alwyn Williams, representing the Royal Society of London (1977).

CHARLES DOOLITTLE WALCOTT MEDALISTS

White, David, 1934
Westergaard, A. H., 1939
Vologdin, Alexander G., 1947
Rasetti, Franco, 1952
Hupé, Pierre, 1957
Öpik, Armin Alexander, 1962
Palmer, Allison Ralph, 1967
Barghoorn, Elso Sterrenberg, 1972

G. K. Warren Prize Fund

In support of an award to be known as the G. K. Warren Prize, in any field of science

Committee: Hollis D. Hedberg, *Chairman:* (1976); Abel Wolman (1976), Allan Cox (1978), John Rogers (1978).

G. K. WARREN PRIZE AWARDEES

Bagnold, R. A., 1969
Leopold, Luna Bergere, 1973
Langbein, Walter B., 1976

James Craig Watson Fund

Gold medal and honorarium awarded for contributions to the science of astronomy and also support for astronomical research

Board of trustees: Paul Herget, *Chairman*, Lawrence Aller, Donald E. Osterbrock, Martin Schwarzschild.

JAMES CRAIG WATSON MEDALISTS

Gould, Benjamin A., 1887
Schoenfeld, Ed., 1889
Auwers, Arthur, 1891
Chandler, S. C., 1894
Gill, Sir David, 1899
Kapteyn, J. C., 1913
Leuschner, A. O., 1916
Charlier, C. V. L., 1924
de Sitter, Willem, 1929
Brown, Ernest William, 1936
Mitchell, Samuel A., 1948
Morgan, Herbert R., 1951
Watts, Chester B., 1955
Van Biesbroeck, George, 1957
Hagihara, Yusuke, 1960
Heckmann, Otto, 1961
Luyten, Willem Jacob, 1964
Herget, Paul, 1965
Eckert, Wallace J., 1966
Moser, Jürgen Kurt, 1969
Deprit, André, 1972
Clemence, G. M., 1975

PRESIDENTS OF THE NATIONAL ACADEMY OF SCIENCES

Name	Year
Alexander Dallas Bache	1863–67
Joseph Henry	1868–78
William Barton Rogers	1879–82
Othniel Charles Marsh	1883–95
Wolcott Gibbs	1895–1900
Alexander Agassiz	1901–07
Ira Remsen	1907–13
William Henry Welch	1913–17
Charles Doolittle Walcott	1917–23
Albert Abraham Michelson	1923–27
Thomas Hunt Morgan	1927–31
William Wallace Campbell	1931–35
Frank Rattray Lillie	1935–39
Frank Baldwin Jewett	1939–47
Alfred Newton Richards	1947–50
Detlev Wulf Bronk	1950–62
Frederick Seitz	1962–69
Philip Handler	1969–

MEDALISTS OF THE NATIONAL ACADEMY OF SCIENCES

Awardee	Medal	Year
Abbe, Cleveland	Welfare	1916
Abbot, Charles Greeley	Draper	1910
Abel, Othenio	Elliot	1920
Adams, Walter Sydney	Draper	1918
Albert I, Prince of Monaco	Agassiz	1918
Alexander, Richard Dale	Elliot	1971
Allen, Edgar Johnson	Agassiz	1937
Anders, Edward	Smith	1971
Arkell, William Joscelyn	Thompson	1944
Auwers, G. F. J. Arthur	Watson	1891
Babcock, Horace W	Draper	1957
Barghoorn, Elso Sterrenberg	Walcott	1972
Bather, Francis Arthur	Thompson	1932
Beadle, George W	Kimber	1960
Beckers, Jacques M	Arctowski	0000
Beebe, William	Elliot	1918
Bent, Arthur Cleveland	Elliot	1949
Berry, Edward Wilber	Thompson	1942
Bethe, Hans Albrecht	Draper	1947
Bigelow, Henry Bryant	Agassiz	1931
Bigelow, Henry Bryant	Elliot	1948
Bjerknes, Vilhelm	Agassiz	1926
Black, Davidson	Elliot	1931
Bowen, Ira Sprague	Draper	1942
Bragg, Sir William Henry	Carty	1939
Bramlette, Milton Nunn	Thompson	1964
Breuil, Henri	Elliot	1924
Bronk, Detlev Wulf	Welfare	1964
Broom, Robert	Elliot	1946
Brown, Ernest William	Watson	1936
Bruun, Anton Frederik	Agassiz	1960
Bullard, Sir Edward	Agassiz	1965
Bush, Vannevar	Welfare	1945
Bush, Vannevar	Carty	1953
Campbell, William Wallace	Draper	1906
Cannon, Annie Jump	Draper	1931
Canu, Ferdinand	Elliot	1923
Carmichael, Leonard	Welfare	1972
Carr, Archie Fairly	Elliot	1952
Carty, John J	Carty	1932
Castle, William Ernest	Kimber	1955
Chandler, Seth Carlo	Watson	1894
Chandrasekhar, S	Draper	1971
Chapin, Charles V	Welfare	1928
Chapin, James P	Elliot	1932
Chapman, Frank Mickler	Elliot	1917
Charlier, C. V. L	Watson	1924
Clarke, John Mason	Thompson	1925
Clemence, G. M	Watson	0000
Coghill, George Ellett	Elliot	1930
Colbert, Edwin H	Elliot	1935
Cole, Rufus	Kovalenko	1966
Compton, Karl Taylor	Welfare	1947
Comroe, Julius H., Jr	Kovalenko	1976
Conklin, Edwin Grant	Carty	1943
Cooper, Gustav Arthur	Thompson	1957
Cumming, Hugh S	Welfare	1935
Daddario, Emilio Q	Welfare	1976
Darlington, Philip J., Jr	Elliot	1957
Deacon, George Edward Raven	Agassiz	1962
Dean, Bashford	Elliot	1921
Defant, Albert	Agassiz	1932
Delbrück, Max	Kimber	1964
Demerec, Milislav	Kimber	1962
Deprit, André	Watson	1972
de Sitter, Willem	Watson	1929
Deslandres, Henri	Draper	1913
Dobzhansky, Theodosius	Elliot	1941
Dobzhansky, Theodosius	Kimber	1958
Doolittle, James H	Welfare	1959
Durand, William Frederick	Carty	1945
Eckart, Carl	Agassiz	1966
Eckert, Wallace J	Watson	1966
Eddington, Sir Arthur Stanley	Draper	1924
Edlén, Bengt	Draper	1968
Eisenberg, Phillip	Gibbs Bros	1974
Ekman, Sven P	Elliot	1953
Ekman, V. Walfrid	Agassiz	1928
Evans, Howard E	Elliott	1976
Ewing, Maurice	Agassiz	1954
Ewing, Maurice	Carty	1963
Fabry, Charles	Draper	1919
Fairchild, David	Welfare	1933
Fowler, Alfred	Draper	1920
Francis, Thomas, Jr	Kovalenko	1970
Friedmann, Herbert	Elliot	1955
Fuglister, Frederick C	Agassiz	1969
Gardiner, J. Stanley	Agassiz	1929
Gardner, John W	Welfare	1966
Gell-Mann, Murray	Carty	1968
Gill, Sir David	Watson	1899
Goethals, George Washington	Welfare	1914
Goodpasture, Ernest W	Kovalenko	1958
Gorgas, William Crawford	Welfare	1914
Gould, Benjamin Apthorp	Watson	1887
Grabau, Amadeus William	Thompson	1936
Gran, Haakan Hasberg	Agassiz	1934
Griffin, Donald Redfield	Elliot	1958
Hagihara, Yusuke	Watson	1960
Haldane, John Burdon Sanderson	Kimber	1961
Hale, George Ellery	Draper	1904
Harrar, J. George	Welfare	1963
Harrison, Ross Granville	Carty	1947
Harvey, H. W	Agassiz	1952
Heckmann, Otto	Watson	1961
Hedberg, Hollis Dow	Thompson	1973
Helland-Hansen, Björn	Agassiz	1933
Henderson, Edward Porter	Smith	1970
Herget, Paul	Watson	1965
Hershey, Alfred Day	Kimber	1965
Hill, Lister	Welfare	1969
Hjort, Johan	Agassiz	1913
Hoover, Herbert Clark	Welfare	1920
Hoover, John Edgar	Welfare	1939
Huggins, Sir William	Draper	1901
Hupé, Pierre	Walcott	1957
Hyman, Libbie Henrietta	Elliot	1951
Inghram, Mark G	Smith	1957
Irwin, Malcolm Robert	Elliot	1938
Iselin II, Columbus	Agassiz	1942
Johnson, Francis Severin	Arctowski	1972
Johnson, Martin Wiggo	Agassiz	1959
Kapteyn, J. C	Watson	1913
Keeler, James Edward	Draper	1899
Keil, Klaus	Merrill	1970
Kety, Seymour Solomon	Kovalenko	1973
Kiel, Alfred Adolf Heinrich	Gibbs Bros	1967
Killian, James R., Jr	Welfare	1956
Knudsen, Martin	Agassiz	1936
Koch, Lauge	Thompson	1949

MEDALISTS OF THE NATIONAL ACADEMY OF SCIENCES—Continued

Awardee	Medal	Year
Koslowski, Roman	Thompson	1958
Langley, Samuel Pierpont	Draper	1886
Langmuir, Irving	Carty	1950
Lashley, Karl Spencer	Elliot	1943
Leuschner, Armin Otto	Watson	1916
Lilienthal, David E.	Welfare	1951
Lillie, Frank Rattray	Agassiz	1939
Link, Karl Paul	Kovalenko	1967
Lull, Richard Swann	Elliot	1933
Luyten, Willem Jacob	Watson	1964
Lyot, Bernard	Draper	1951
Margerie, Emmanuel de	Thompson	1923
Marmer, Harry A	Agassiz	1951
Mather, Stephen Tyng	Welfare	1930
Mayr, Ernst	Elliot	1967
McClintock, Barbara	Kimber	1967
McLearn, Frank	Thompson	1948
Mees, C. E. Kenneth	Draper	1936
Merrill, George Perkins	Smith	1922
Merrill, Paul Willard	Draper	1945
Meyer, Karl Friedrich	Kovalenko	1961
Michelson, Albert Abraham	Draper	1916
Millman, Peter Mackenzie	Smith	1954
Mitchell, Samuel A.	Watson	1948
Moe, Henry Allen	Welfare	1958
Moore, Raymond Cecil	Thompson	1970
Morgan, Herbert R	Watson	1951
Moser, Jurgen Kurt	Watson	1969
Muller, Hermann Joseph	Kimber	1955
Munk, Walter H.	Agassiz	1976
Murphy, Robert Cushman	Elliot	1936
Newell, Norman Dennis	Thompson	1961
Newton, Hubert Anson	Smith	1888
Niedermair, John C.	Gibbs Bros.	1976
Northrop, John Howard	Elliot	1939
Opie, Eugene Lindsay	Kovalenko	1959
Opik, Armin Alexander	Walcott	1962
Opik, Ernst J.	Smith	1960
Osborn, Henry Fairfield	Elliot	1929
Osburn, Raymond Carroll	Elliot	1950
Painter, Theophilus Shickel	Elliot	1934
Palmer, Allison Ralph	Walcott	1967
Park, William Hallock	Welfare	1932
Parker, Eugene Norman	Arctowski	1969
Parker, George Howard	Elliot	1937
Patterson, Clair Cameron	Smith	1973
Patterson, John Thomas	Elliot	1947
Perry, Stuart Hoffman	Smith	1945
Pettersson, Otto Sven	Agassiz	1924
Pickering, Edward Charles	Draper	1888
Pinchot, Gifford	Welfare	1916
Plaskett, John Stanley	Draper	1934
Proudman, Joseph	Agassiz	1946
Rasetti, Franco	Walcott	1952
Redfield, Alfred Clarence	Agassiz	1955
Reeside, John B., Jr.	Thompson	1946
Revelle, Roger R.	Agassiz	1963
Reynolds, John Hamilton	Smith	1967
Richards, Alfred Newton	Kovalenko	1952
Ridgway, Robert	Elliot	1919
Rockefeller, John Davison, Jr.	Welfare	1943
Romer, Alfred Sherwood	Thompson	1954
Romer, Alfred Sherwood	Elliot	1956
Rose, Wickliffe	Welfare	1931
Rous, Peyton	Kovalenko	1955
Rowland, Henry Augustus	Draper	1890
Russell, F. F.	Welfare	1935
Russell, Henry Norris	Draper	1922
Ryle, Martin	Draper	1965
Schade, Henry Adrian	Gibbs Bros.	1971
Schmidt, Johannes	Agassiz	1930
Schmitt, Roman A.	Merrill	1972
Schoenfeld, Ed.	Watson	1889
Schopf, James M.	Thompson	1976
Schuchert, Charles	Thompson	1934
Schwarzschild, Martin	Draper	1960
Scott, William Berryman	Thompson	1930
Scott, William Berryman	Elliot	1940
Seton, Ernest Thompson	Elliot	1928
Shannon, James A.	Welfare	1962
Shapley, Harlow	Draper	1926
Shull, George Harrison	Welfare	1948
Sigsbee, Charles Dwight	Agassiz	1920
Simpson, George Gaylord	Thompson	1943
Simpson, George Gaylord	Elliot	1944
Simpson, George Gaylord	Elliot	1965
Slipher, V. M.	Draper	1932
Smith, James Perrin	Thompson	1928
Sonneborn, Tracy Morton	Kimber	1959
Spitzer, Lyman, Jr.	Draper	1974
Stebbins, Joel	Draper	1915
Steele, John H.	Agassiz	1973
Stensiö, Erik A.: Son	Elliot	1927
Stephenson, Lloyd William	Thompson	1952
Stern, Curt	Kimber	1963
Stiles, Charles Wardell	Welfare	1921
Stratton, Samuel Wesley	Welfare	1917
Struve, Otto	Draper	1949
Sturtevant, A. H.	Kimber	1957
Sturtevant, A. H.	Carty	1965
Sverdrup, Harald Ulrik	Agassiz	1938
Thompson, Sir D'Arcy Wentworth	Elliot	1942
Thompson, Thomas Gordon	Agassiz	1948
Timofeeff-Ressovsky, Nikolai V.	Kimber	1966
Todd, Frederick H.	Gibbs Bros.	1965
Tousey, Richard	Draper	1963
Townes, Charles Hard	Carty	1961
Ulrich, Edward Oscar	Thompson	1930
Urey, Harold Clayton	Smith	1962
Uyeda, Seiya	Agassiz	1972
Van Biesbroeck, George	Watson	1957
van de Hulst, H. C.	Draper	1955
Vaughan, T. Wayland	Agassiz	1935
Vaughan, T. Wayland	Thompson	1945
Vening Meinesz, Felix Andries	Agassiz	1947
Vogel, Herman Karl	Draper	1893
Vollmer, August	Welfare	1934
Vologdin, Alexander G.	Walcott	1947
Walcott, Charles Doolittle	Thompson	1921
Waterman, Alan T.	Welfare	1960
Watson, David Meredith Seares	Thompson	1941
Watson, James Dewey	Carty	1971
Watts, Chester B.	Watson	1955
Weaver, Warren	Welfare	1957
Weber, Max	Agassiz	1927
Westergaard, A. H.	Walcott	1939
Wheeler, William Morton	Elliot	1922
Whipple, Fred Lawrence	Smith	1949
Whipple, George Hoyt	Kovalenko	1962
White, David	Thompson	1931
White, David	Walcott	1934
Whitney, Willis Rodney	Welfare	1937
Wild, J. Paul	Arctowski	1969
Wilson, Edmund Beecher	Elliot	1925
Wilson, Edmund Beecher	Carty	1936
Wilson, J. Tuzo	Carty	1975
Wood, John Armstead	Smith	1976
Wood, Robert Williams	Draper	1940
Woodring, Wendell Phillips	Thompson	1967
Woodward, Sir Arthur Smith	Thompson	1942
Wright, Sewall	Elliot	1945
Wright, Sewall	Kimber	1956
Wright, William Hammond	Draper	1928
Zeeman, Pieter	Draper	1921

RECIPIENTS OF PRIZES AND OTHER AWARDS

Awardee	Prize or Award	Date
Alberts, Bruce M.	Molecular Biology	1975
Bagnold, R. A.	Warren Prize	1969
Baltimore, David	Molecular Biology	1974
Barnett, Samuel J.	Comstock Prize	1918
Bridgman, Percy W.	Comstock Prize	1933
Brown, Donald David	Molecular Biology	1973
*Cooper, Leon N.	Comstock Prize	1968
Davisson, C. J.	Comstock Prize	1928
Dicke, Robert H.	Comstock Prize	1973
Douglas, Donald Wills, Sr.	Aeronautical Engineering	1973
Duane, William	Comstock Prize	1923
Dulbecco, Renato	Waksman Award	1974
Edgar, Robert Stuart	Molecular Biology	1965
Edmondson, W. Thomas	Environmental Quality	1973
Evans, David M.	Environmental Quality	1976
Friedrichs, Kurt Otto	Appl. Mathematics & Numerical Analysis	1972
Gilbert, Walter	Molecular Biology	1968
Grumman, Leroy Randle	Aeronautical Engineering	1968
Haagen-Smit, Arie Jan	Environmental Quality	1972
Hutchinson, G. Evelyn	Environmental Quality	1974
Holley, Robert W.	Molecular Biology	1967
Kaiser, Armin Dale	Molecular Biology	1970
Karlin, Samuel	Appl. Mathematics & Numerical Analysis	1973
Kellermann, Kenneth I.	Gould Prize	1973
Kerst, Donald W.	Comstock Prize	1943
Langbein, Walter B.	Warren	1976
Lawrence, Ernest O.	Comstock Prize	1938
Leopold, Luna Bergere	Warren Prize	1973
Matthews, Drummond H.	Day Prize	1975
Meselson, Matthew S.	Molecular Biology	1963
Middleton, John T.	Environmental Quality	1975
Millikan, Robert A.	Comstock Prize	1913
Nathans, Daniel	Molecular Biology	1976
Nirenberg, Marshall W.	Molecular Biology	1962
Nomura, Masayasu	Molecular Biology	1971
Rees, Martin, Robertson	Lecture	1975
Roemer, Elizabeth	Gould Prize	1971
Rowe, Wallace	Waksman	1976
*Schrieffer, J. Robert	Comstock Prize	1968
Shockley, William	Comstock [illegible]	[illegible]
Stadtman, Earl Reece	Microbiology	[illegible]
Strominger, Jack L.	Microbiology	1968
Temin, Howard	Molecular Biology	1972
Townes, Charles Hard	Comstock Prize	1958
Tuve, Merle A.	Comstock Prize	1948
Vine, Fred J.	Day Prize	1975
Woltjer, Lodewijk	Gould Prize	1975
Wood, III, William Barry	Molecular Biology	1969
Wu, Chien-Shiung	Comstock Prize	1963
Yanofsky, Charles	Molecular Biology	1964
Yanofsky, Charles	Microbiology	1972
Yoder, Hatten Schuyler, Jr.	Day Prize and Lectureship	1972
Zinder, Norton D.	Molecular Biology	1966

*Joint award.

NATIONAL ACADEMY OF SCIENCES STAFF AWARD RECIPIENTS

Awardee	Prize or Award	Date
Carey, William N., Jr.	NAS Staff Award	1973
Green, Robert Eugene	NAS Staff Award	1974
Jablon, Seymour	NAS Staff Award	1975
Odishaw, Hugh	NAS Staff Award	1972
Reed, Charles K.	NAS Staff Award	1976

DECEASED MEMBERS
OF THE NATIONAL ACADEMY OF SCIENCES

March 1863 through June 1976

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Abbe, Cleveland	Dec. 3, 1838	1879	Oct. 28, 1916	8
Abbot, Charles Greeley	May 31, 1872	1915	Dec. 17, 1973	..
Abbot, Henry Larcom	Aug. 13, 1831	1872	Oct. 1, 1927	13
Abel, John Jacob	May 19, 1857	1912	May 26, 1938	24
Adams, Comfort Avery	Nov. 1, 1868	1930	Feb. 21, 1958	38
Adams, Leason H.	Jan. 16, 1887	1943	Aug. 20, 1969	..
Adams, Roger	Jan. 2, 1889	1929	July 6, 1971	..
Adams, Walter Sydney	Dec. 20, 1876	1917	May 11, 1956	31
Addis, Thomas	July 27, 1881	1944	June 4, 1949	..
Adkins, Homer	Jan. 16, 1892	1942	Aug. 10, 1949	22
Agassiz, Alexander	Dec. 17, 1835	1866	Mar. 27, 1910	2
Agassiz, Louis	May 28, 1807	(1)	Dec. 14, 1873	1
Aitken, Robert Grant	Dec. 31, 1864	1918	Oct. 29, 1951	32
Albert, Abraham Adrian	Nov. 9, 1905	1943	June 6, 1972	..
Albright, Fuller	Jan. 12, 1900	1952	Dec. 8, 1969	48
Albright, William Foxwell	May 24, 1891	1955	Sept. 19, 1971	..

See footnotes at end of table.

*Except as noted otherwise in the list of numbered footnotes at the end of the table, the numbers in this column refer to the volumes in the series of "Biographical Memoirs" of deceased members published by the National Academy of Sciences.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Alexander, James Waddell	Sept. 19, 1888	1930	Sept 23, 1971	--
Alexander, John H.	June 26, 1812	(1)	Mar. 2, 1867	2
Alexander, Stephen	Sept. 1, 1806	(1)	June 25, 1883	1
Allee, Warder Clyde	June 5, 1885	1931	Mar. 18, 1955	30
Allen, Charles Elmer	Oct. 4, 1872	1924	June 25, 1954	29
Allen, Eugene Thomas	Apr. 2, 1864	1930	July 17, 1964	40
Allen, Joel Asaph	July 19, 1838	1876	Aug. 29, 1921	[2]21
Allison, Samuel King	Nov. 13, 1900	1946	Sept. 15, 1965	--
Ames, Joseph Sweetman	July 3, 1864	1909	June 24, 1943	23
Anderson, Edgar	Nov. 9, 1897	1954	June 18, 1969	49
Anderson, John August	Aug. 7, 1876	1928	Dec. 2, 1959	36
Anderson, Rudoph John	Sept. 13, 1879	1946	Apr. 6, 1961	36
Angell, James Roland	May 8, 1869	1920	Mar. 4, 1949	26
Armsby, Henry Prentiss	Sept. 21, 1853	1920	Oct. 19, 1921	19
Armstrong, Charles	Sept. 25, 1886	1944	June 22, 1967	--
Astwood, Edwin Bennett	Dec. 29, 1909	1957	Feb. 17, 1976	--
Atkinson, George Francis	Jan. 25, 1854	1918	Nov. 14, 1918	29
Aub, Joseph Charles	May 30, 1890	1957	Dec. 30, 1973	--
Avery, Oswald Theodore	Oct. 21, 1877	1933	Feb. 20, 1955	32
Babcock, Ernest Brown	July 10, 1877	1946	Dec. 8, 1954	32
Babcock, Harold Delos	Jan. 24, 1882	1933	Apr. 8, 1968	45
Bache, Alexander Dallas	July 19, 1806	(1)	Feb. 17, 1867	1
Bachmann, Werner Emmanuel	Nov. 13, 1901	1941	Mar. 22, 1951	34
Badger, Richard McLean	May 4, 1896	1952	Nov. 26, 1974	--
Baekeland, Leo Hendrik	Nov. 14, 1863	1936	Feb. 23, 1944	24
Bailey, Irving Widmer	Aug. 15, 1884	1929	May 16, 1967	45
Bailey, Liberty Hyde	Mar. 15, 1858	1917	Dec. 25, 1954	--
Bailey, Percival	May 9, 1892	1953	Aug. 10, 1973	49
Bailey, Solon Irving	Dec. 29, 1854	1923	June 5, 1931	15
Bain, Edgar Collins	Sept. 14, 1891	1954	Nov. 27, 1971	49
Baird, Spencer F.	Feb. 3, 1823	1864	Aug. 19, 1887	3
Balls, Arnold Kent	Apr. 2, 1891	1954	May 25, 1966	41
Bancroft, Wilder Dwight	Oct. 1, 1867	1920	Feb. 7, 1953	--
Barbour, Thomas	Aug. 19, 1884	1933	Jan. 8, 1946	27
Barker, George F.	July 14, 1835	1876	May 24, 1910	--
Barnard, Edward Emerson	Dec. 16, 1857	1911	Feb. 6, 1923	[2]21
Barnard, F. A. P.	May 5, 1809	(1)	Apr. 27, 1889	20
Barnard, John Gross	May 19, 1815	(1)	May 14, 1882	5
Barrell, Joseph	Dec. 15, 1869	1919	May 4, 1919	12
Bartlett, W. H. C.	Sept. 1804	(1)	Feb. 11, 1893	7
Bartelmez, George William	Mar. 23, 1885	1949	Sept. 2, 1967	43
Barus, Carl	Feb. 19, 1856	1892	Sept. 20, 1935	22
Bateman, Harry	May 29, 1882	1930	Jan. 21, 1946	25
Baxter, Gregory Paul	Mar. 3, 1876	1916	Feb. 10, 1953	--
Becker, George Ferdinand	Jan. 5, 1847	1901	Apr. 20, 1919	[2]21
Beecher, Charles Emerson	Oct. 9, 1856	1899	Feb. 14, 1904	6
Bell, Alexander Graham	Mar. 3, 1847	1883	Aug. 2, 1922	23
Bell, Eric Temple	Feb. 7, 1883	1927	Dec. 21, 1960	--
Benedict, Francis Gano	Oct. 13, 1870	1914	May 14, 1957	32
Benedict, Stanley Rossiter	Mar. 17, 1884	1924	Dec. 21, 1936	27
Benioff, Victor Hugo	Sept. 14, 1899	1953	Feb. 29, 1968	43
Berkey, Charles Peter	Mar. 25, 1867	1927	Aug. 22, 1955	30
Berkner, Lloyd Viel	Feb. 1, 1905	1948	June 4, 1967	--
Berry, Edward Wilber	Feb. 10, 1875	1922	Sept. 20, 1945	45
Berson, Solomon Aaron	Apr. 22, 1918	1972	Apr. 11, 1972	--
Bigelow, Henry Bryant	Oct. 3, 1879	1931	Dec. 11, 1967	48
Billings, John Shaw	Apr. 12, 1838	1883	Mar. 11, 1913	8
Birkhoff, George David	Mar. 21, 1884	1918	Nov. 12, 1944	--
Bishop, George Holman	June 27, 1889	1967	Oct. 11, 1973	--
Bjerknes, Jacob	Nov. 2, 1897	1947	July 7, 1975	--
Blackwelder, Eliot	June 4, 1880	1936	Jan. 14, 1969	48
Blake, Francis Gilman	Feb. 22, 1887	1947	Feb. 1, 1952	28
Blakeslee, Albert Francis	Nov. 9, 1874	1929	Nov. 16, 1954	33
Blalock, Alfred	Apr. 5, 1899	1945	Sept. 15, 1964	--
Blichfeldt, Hans Frederik	Jan. 9, 1873	1920	Nov. 16, 1945	26
Bliss, Gilbert Ames	May 9, 1876	1916	May 8, 1951	31
Bloom, William	Sept. 15, 1899	1954	May 11, 1972	--
Boas, Frans	July 9, 1858	1900	Dec. 21, 1942	24
Bocher, Maxime	Aug. 28, 1867	1909	Sept. 12, 1918	--
Bodine, Joseph Hall	Sept. 19, 1895	1953	July 23, 1954	--
Bogert, Marston Taylor	Apr. 18, 1868	1916	Mar. 21, 1954	45
Bolton, Elmer K.	June 23, 1886	1946	July 30, 1968	--
Boltwood, Bertram Borden	July 27, 1870	1911	Aug. 14, 1927	14
Bonner, David Mahlon	May 15, 1916	1959	May 2, 1964	--
Bonner, Tom Wilkerson	Oct. 19, 1910	1959	Dec. 6, 1961	38
Boring, Edwin Garrigues	Oct. 23, 1886	1932	July 1, 1968	43
Borthwick, Harry Alfred	Jan. 7, 1898	1961	May 21, 1974	48
Boss, Lewis	Oct. 26, 1846	1889	Oct. 5, 1912	9
Bowditch, Henry Pickering	Apr. 4, 1840	1887	Mar. 13, 1911	17
Bowen, Ira Sprague	Dec. 21, 1898	1936	Feb. 6, 1973	--
Bowen, Norman Levi	June 21, 1887	1935	Sept. 11, 1956	--
Bowie, William	May 6, 1872	1927	Aug. 28, 1940	26

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Bowman, Isaiah	Dec. 26, 1878	1930	Jan. 6, 1950	33
Branner, John Casper	July 4, 1850	1905	Mar. 1, 1922	21
Bray, William Crowell	Sept. 2, 1879	1924	Feb. 24, 1946	26
Breasted, James Henry	Aug. 27, 1865	1923	Dec. 2, 1935	18
Brewer, William Henry	Sept. 14, 1828	1880	Nov. 2, 1910	12
Bridges, Calvin Blackman	Jan 11, 1889	1937	Dec. 27, 1938	22
Bridgman, Percy Williams	Apr. 21, 1882	1918	Aug. 20, 1961	41
Briggs, Lyman, Jr.	May 7, 1874	1942	Mar. 25, 1963	--
Brillouin, Leon	Aug. 7, 1889	1953	Oct. 4, 1969	--
Britton, Nathaniel Lord	Jan. 15, 1859	1914	June 25, 1934	19
Brode, Wallace Reed	June 12, 1900	1954	Aug. 10, 1974	
Bronk, Detlev Wulf	Aug. 13, 1897	1939	Nov. 17, 1975	--
Brooks, William Keith	Mar. 25, 1848	1884	Nov. 12, 1908	7
Brouwer, Dirk	Sept. 1, 1902	1951	Jan. 31, 1966	41
Brown, Ernest William	Nov. 29, 1866	1923	July 22, 1938	21
Brown-Sequard, Charles E.	Apr. 8, 1817	1868	Apr. 2, 1894	4
Brush, George Jarvis	Dec. 15, 1831	1868	Feb. 6, 1912	17
Bucher, Walter Hermann	May 12, 1888	1938	Feb. 17, 1965	40
Buckley, Oliver Ellsworth	Aug. 8, 1887	1937	Dec. 14, 1959	37
Burkholder, Paul Rufus	Feb. 1, 1903	1949	Aug. 11, 1972	--
Bumstead, Henry Andrews	Mar. 12, 1870	1913	Dec. 31, 1920	13
Burgess, George Kimball	Jan. 4, 1874	1922	July 2, 1932	30
Bush, Vannevar	Mar. 11, 1890	1934	June 28, 1974	--
Calkins, Gary Nathan	Jan. 18, 1869	1919	Jan. 4, 1943	--
Campbell, Douglas Houghton	Dec. 16, 1859	1910	Feb. 23, 1953	29
Campbell, William Wallace	Apr. 11, 1862	1902	June 14, 1938	25
Cannan, Robert Keith	Apr. 18, 1894	1969	June 18, 1971	--
Cannon, Walter Bradford	Oct. 19, 1871	1914	Oct. 1, 1945	--
Carlson, Anton Julius	Jan. 29, 1875	1920	Sept. 2, 1956	35
Carmichael, Leonard	Nov. 9, 1898	1943	Sept. 16, 1973	--
Carothers, Wallace Hume	Apr. 27, 1896	1936	Apr. 29, 1937	20
Carty, John Joseph	Apr. 14, 1861	1917	Dec. 27, 1932	18
Casey, Thomas Lincoln	May 10, 1831	1890	Mar. 25, 1896	4
Castle, William Ernest	Oct. 25, 1867	1915	June 3, 1962	38
Caswell, Alexis	Jan. 29, 1799	(1)	Jan. 8, 1877	6
Cattell, James McKeen	May 25, 1860	1901	Jan. 20, 1944	25
Chamberlin, Rollin Thomas	Oct. 20, 1881	1940	Mar. 6, 1948	41
Chamberlin, Thomas Chrowder	Sept. 25, 1843	1903	Nov. 15, 1928	15
Chandler, Charles Frederick	Dec. 6, 1836	1874	Aug. 25, 1925	14
Chandler, Seth Carlo	Sept. 17, 1846	1888	Dec. 31, 1913	--
Chandler, William Henry	July 1, 1878	1943	Oct. 29, 1970	--
Chaney, Ralph Works	Aug. 24, 1890	1947	Mar. 3, 1971	--
Chapman, Frank Michler	June 12, 1864	1921	Nov. 15, 1945	25
Chauvenet, William	May 24, 1820	(1)	Dec. 13, 1870	1
Child, Charles Manning	Feb. 2, 1869	1935	Dec. 19, 1954	30
Chittenden, Russell Henry	Feb. 18, 1856	1890	Dec. 26, 1943	24
Clark, Henry James	June 22, 1826	1872	July 1, 1873	1
Clark, William Bullock	Dec. 15, 1860	1908	July 27, 1917	9
Clark, William Mansfield	Aug. 17, 1884	1928	Jan. 19, 1964	39
Clarke, Frank Wigglesworth	Mar. 19, 1847	1909	May 23, 1931	15
Clarke, Hans Thacher	Dec. 27, 1887	1942	Oct. 21, 1972	46
Clarke, John Mason	Apr. 15, 1857	1909	May 29, 1925	12
Clausen, Jens Christian	Mar. 11, 1891	1959	Nov. 22, 1969	--
Clausen, Roy Elwood	Aug. 21, 1891	1951	Aug. 21, 1956	39
Cleland, Ralph Erskine	Oct. 20, 1892	1942	June 11, 1971	--
Clemence, Gerald Maurice	Aug. 16, 1908	1952	Nov. 22, 1974	--
Cleveland, Lemuel Roscow	Nov. 14, 1892	1952	Feb. 12, 1969	--
Clinton, George Perkins	May 7, 1867	1930	Aug. 13, 1937	20
Cloos, Ernst	May 17, 1898	1950	May 28, 1974	--
Coble, Arthur Byron	Nov. 3, 1878	1924	Dec. 8, 1966	--
Coblentz, William Weber	Nov. 20, 1873	1930	Sept. 15, 1962	39
Cochrane, Edward Lull	Mar. 18, 1892	1945	Nov. 14, 1959	35
Coffin, James H.	Sept. 6, 1806	1869	Feb. 6, 1873	1
Coffin, J. H. C.	Sept. 14, 1815	(1)	Jan. 8, 1890	8
Coghill, George Ellett	Mar. 17, 1872	1935	July 23, 1941	22
Cohn, Edwin Joseph	Dec. 17, 1892	1943	Oct. 1, 1953	35
Cole, Rufus	Apr. 30, 1872	1922	Apr. 20, 1966	--
Compton, Arthur Holly	Sept. 10, 1892	1927	Mar. 15, 1962	38
Compton, Karl Taylor	Sept. 14, 1887	1924	June 22, 1954	--
Comstock, Cyrus B.	Feb. 3, 1831	1884	May 29, 1910	7
Comstock, George Cary	Feb. 12, 1855	1899	May 11, 1934	20
Condon, Edward Uhler	Mar. 2, 1902	1944	Mar. 25, 1974	48
Conklin, Edwin Grant	Nov. 24, 1863	1908	Nov. 20, 1952	31
Cook, George Hammell	Jan. 5, 1818	1887	Sept. 22, 1889	4
Cooke, Josiah Parsons	Oct. 12, 1827	1872	Sept. 3, 1894	4
Coolidge, William David	Oct. 23, 1873	1925	Feb. 3, 1975	--
Cope, Arthur Clay	June 27, 1909	1947	June 4, 1965	--
Cope, Edward Drinker	July 28, 1840	1872	Apr. 12, 1897	13
Corey, Robert Brainard	Aug. 19, 1897	1970	Apr. 23, 1971	--
Cori, Gerty Theresa	Aug. 15, 1896	1948	Oct. 26, 1957	--
Cottrell, Frederick Gardner	Jan. 10, 1877	1939	Nov. 16, 1948	27
Coues, Elliott	Sept. 9, 1842	1877	Dec. 25, 1899	6

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Courant, Richard	Jan. 8, 1888	1955	Jan. 27, 1972	..
Coulter, John Merle	Nov. 20, 1851	1909	Dec. 23, 1928	14
Councilman, William Thomas	Jan. 1, 1854	1904	May 27, 1933	18
Crafts, James Mason	Mar. 8, 1839	1872	June 20, 1917	9
Craig, Lyman Creighton	June 12, 1906	1950	July 7, 1974	49
Crew, Henry	June 4, 1859	1909	Feb. 17, 1953	37
Cross, (Charles) Whitman	Sept. 1, 1854	1908	Apr. 20, 1949	32
Curtis, Heber Doust	June 27, 1872	1919	Jan. 9, 1942	22
Cushing, Harvey (Williams)	Apr. 8, 1869	1917	Oct. 7, 1939	22
Dall, William Healey	Aug. 21, 1845	1897	Mar. 27, 1927	31
Dalton, John Call	Feb. 2, 1825	1864	Feb. 2, 1889	3
Daly, Reginald Aldworth	May 19, 1871	1925	Sept. 19, 1957	34
Dana, Edward Salisbury	Nov. 16, 1849	1884	June 16, 1935	18
Dana, James Dwight	Feb. 12, 1813	(1)	Apr. 4, 1895	9
Danforth, Charles Haskell	Nov. 30, 1883	1952	Jan. 10, 1969	44
Daniels, Farrington	Mar. 9, 1889	1947	June 23, 1972	..
Davenport, Charles Benedict	June 1, 1866	1912	Feb. 18, 1944	25
Davidson, George	May 9, 1825	1874	Dec. 2, 1911	18
Davis, Bergen	Mar. 31, 1869	1929	June 30, 1958	34
Davis, Charles Henry	Jan. 16, 1807	(1)	Feb. 18, 1877	4
Davis, William Morris	Feb. 12, 1850	1904	Feb. 5, 1934	23
Davisson, Clinton Joseph	Oct. 22, 1881	1929	Feb. 1, 1958	36
Day, Arthur Louis	Oct. 30, 1869	1911	Mar. 2, 1960	..
Debye, Peter[3]	Mar. 24, 1884	1947	Nov. 2, 1966	46
DeGolyer, Everette Lee	Oct. 9, 1886	1951	Dec. 14, 1956	33
Demerec, Milislav	Jan. 11, 1895	1946	Apr. 12, 1966	42
Dempster, Arthur Jeffrey	Aug. 14, 1886	1937	Mar. 11, 1950	27
Dennison, David Mathias	Apr. 26, 1900	1953	Apr. 3, 1976	..
Detwiler, Samuel Randall	Feb. 17, 1890	1932	May 2, 1957	35
Dewey, John	Oct. 20, 1859	1910	June 1, 1952	30
Dickson, Leonard Eugene	Jan. 22, 1874	1913	Jan. 17, 1954	..
Dingle, John Holmes	Nov. 24, 1908	1958	Aug. 15, 1973	..
Dobzhansky, Theodosius	Jan. 25, 1900	1943	Dec. 19, 1975	..
Dochez, Alphonse Raymond	Apr. 21, 1882	1933	June 30, 1964	42
Dodge, Bernard Ogilvie	Apr. 18, 1872	1933	Aug. 9, 1960	36
Dodge, Raymond	Feb. 20, 1871	1924	Apr. 8, 1942	29
Donaldson, Henry Herbert	May 12, 1857	1914	Jan. 23, 1938	20
Doudoroff, Michael	Nov. 14, 1911	1962	Apr. 4, 1975	..
Douglas, Jesse	July 3, 1897	1946	Oct. 7, 1965	..
Dragstedt, Lester Reynold	Oct. 2, 1893	1950	July 16, 1975	..
Draper, Henry	Mar. 7, 1837	1877	Nov. 20, 1882	3
Draper, John William	May 5, 1811	1877	Jan. 4, 1882	2
Dryden, Hugh Latimer	July 2, 1898	1944	Dec. 2, 1965	40
Duane, William	Feb. 17, 1872	1920	Mar. 7, 1935	18
DuBois, Eugene Floyd	June 4, 1882	1933	Feb. 12, 1959	36
Duggar, Benjamin Minge	Sept. 1, 1872	1927	Sept. 10, 1956	32
Dunn, Gano	Oct. 18, 1870	1919	Apr. 18, 1953	28
Dunn, Leslie Clarence	Nov. 2, 1893	1943	Mar. 19, 1974	49
Dunning, John Ray	Sept. 24, 1907	1948	Aug. 25, 1975	..
Durand, William Frederick	Mar. 5, 1859	1917	Aug. 9, 1958	48
Dutton, Clarence Edward	May 15, 1841	1884	Jan. 4, 1912	32
Eads, James Buchanan	May 23, 1820	1872	Mar. 8, 1887	3
East, Edward Murray	Oct. 4, 1879	1925	Nov. 9, 1938	23
Eckart, Carl Henry	May 4, 1902	1953	Oct. 23, 1973	48
Edison, Thomas Alva	Feb. 11, 1847	1927	Oct. 18, 1931	15
Eigenmann, Carl H.	Mar. 9, 1863	1923	Apr. 24, 1927	18
Einstein, Albert[4]	Mar. 14, 1879	1942	Apr. 18, 1955	..
Eisenhart, Luther Pfahler	Jan. 13, 1876	1922	Oct. 28, 1965	40
Elkin, William Lewis	Apr. 29, 1855	1895	May 30, 1933	18
Elvehjem, Conrad Arnold	May 27, 1901	1942	July 27, 1962	..
Emerson, Robert	Nov. 4, 1903	1953	Feb. 3, 1959	35
Emerson, Rollins Adams	May 5, 1873	1927	Dec. 8, 1947	25
Emmet, William LeRoy	July 10, 1859	1921	Sept. 26, 1941	22
Emmons, Samuel Franklin	Mar. 29, 1841	1892	Mar. 28, 1911	7
Engelmann, George	Feb. 2, 1809	(1)	Feb. 4, 1884	4
Epstein, Paul Sophus	Mar. 20, 1883	1930	Feb. 8, 1966	45
Erlanger, Joseph	Jan. 5, 1874	1922	Dec. 5, 1965	41
Evans, Griffith Conrad	May 11, 1887	1933	Dec. 8, 1973	..
Evans, Herbert McLean	Sept. 23, 1882	1927	Mar. 6, 1971	45
Ewing, James	Dec. 25, 1866	1935	May 16, 1943	26
Ewing, William Maurice	May 12, 1906	1948	May 4, 1974	..
Farlow, William Gilson	Dec. 17, 1844	1879	June 3, 1919	21
Feller, William	July 7, 1906	1960	Jan. 14, 1970	..
Fenn, Wallace Osgood	Apr. 27, 1883	1943	Sept. 20, 1971	..
Fermi, Enrico	Sept. 29, 1901	1945	Nov. 28, 1954	30
Fernald, Merritt Lyndon	Oct. 5, 1873	1935	Sept. 22, 1950	28
Ferrel, William	Jan. 29, 1817	1868	Sept. 18, 1891	13
Fewkes, Jesse Walter	Nov. 14, 1850	1914	May 31, 1930	5
Fischer, Hermann Otto Laurenz	Dec. 16, 1888	1954	Mar. 9, 1960	40
Fleming, John Adam	Jan. 28, 1877	1938	July 29, 1956	39
Flexner, Simon	Mar. 25, 1863	1908	May 2, 1946	..
Folin, Otto	Apr. 4, 1867	1916	Oct. 25, 1934	27

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Foote, Paul Darwin	Mar. 27, 1888	1943	Aug. 2, 1971	..
Forbes, Alexander	May 14, 1882	1936	Mar. 27, 1965	40
Forbes, Stephen Alfred	May 29, 1844	1918	Mar. 13, 1930	15
Francis, Thomas, Jr.	July 15, 1900	1948	Oct. 1, 1969	44
Franck, James	Aug. 26, 1882	1944	May 21, 1964	..
Franklin, Edward Curtis	Mar. 1, 1862	1914	Feb. 4, 1937	..
Frazer, John Fries	July 8, 1812	(1)	Oct. 12, 1872	1
Freeman, John Ripley	July 27, 1855	1918	Oct. 6, 1932	17
Frost, Edwin Brant	July 14, 1866	1908	May 14, 1935	19
Gabb, William More	Jan. 20, 1839	1876	May 30, 1878	6
Gamble, James Lawder	July 18, 1883	1945	May 28, 1959	36
Gamow, George	Mar. 4, 1904	1953	Aug. 20, 1968	..
Gasser, Herbert Spencer	July 5, 1888	1934	May 11, 1963	..
Gay, Frederick Parker	July 22, 1874	1939	July 14, 1939	28
Genth, F. A.	May 17, 1820	1872	Feb. 2, 1893	4
Gerard, Ralph Waldo	Oct. 7, 1900	1955	Feb. 17, 1974	..
Gesell, Arnold Lucius	June 21, 1880	1947	May 29, 1961	37
Gherardi, Bancroft	Apr. 6, 1873	1933	Aug. 14, 1941	30
Gibbon, John Heysham, Jr.	Sept. 29, 1903	1972	Feb. 5, 1973	..
Gibbs, Josiah Willard	Feb. 11, 1839	1879	Apr. 28, 1903	6
Gibbs, William Francis	Aug. 24, 1886	1949	Sept. 6, 1967	42
Gibbs, Wolcott	Feb. 21, 1822	(1)	Dec. 9, 1908	7
Gilbert, Grove Karl	May 6, 1843	1883	May 1, 1918	[2] 21
Gill, Theodore Nicholas	Mar. 21, 1837	1873	Sept. 25, 1914	8
Gilliland, Edwin Richard	July 10, 1909	1948	Mar. 10, 1973	49
Gilliss, James Melville	Sept. 4, 1811	(1)	Feb. 9, 1865	1
Goldschmidt, Richard Benedikt	Apr. 12, 1878	1947	Apr. 24, 1958	39
Gomberg, Moses	Feb. 8, 1866	1914	Feb. 12, 1947	41
Gooch, Frank Austin	May 2, 1852	1897	Aug. 12, 1929	15
Goodale, George Lincoln	Aug. 3, 1839	1890	Apr. 15, 1923	[2] 21
Goode, G. Brown	Feb. 13, 1851	1888	Sept. 6, 1896	4
Goodpasture, Ernest William	Oct. 17, 1886	1937	Sept. 20, 1960	38
Gortner, Ross Aiken	Mar. 20, 1885	1935	Sept. 30, 1942	23
Gould, Augustus A.	Apr. 23, 1805	(1)	Sept. 15, 1866	5
Gould, Benjamin A.	Sept. 27, 1824	(1)	Nov. 26, 1896	[2] 17
Graham, Clarence Henry	Jan. 6, 1906	1946	July 25, 1971	46
Graham, Evarts Ambrose	Mar. 19, 1883	1941	Mar. 4, 1957	48
Gray, Asa	Nov. 18, 1810	(1)	Jan. 30, 1888	3
Gregory, William King	May 19, 1876	1927	Dec. 29, 1970	46
Griggs, David Tressel	Oct. 6, 1911	1952	Dec. 31, 1974	..
Gunn, Ross	May 12, 1897	1931	Nov. 24, 1966	..
Gutenberg, Beno	June 4, 1889	1945	Jan. 25, 1960	..
Guyot, Arnold	Sept. 28, 1807	(1)	Feb. 8, 1884	5
Hadley, James	Mar. 30, 1821	1872	Nov. 14, 1872	5
Hague, Arnold	Dec. 3, 1840	1885	May 14, 1917	9
Haldeman, S. S.	Aug. 12, 1812	1876	Sept. 20, 1880	2
Hale, George Ellery	June 29, 1868	1902	Feb. 21, 1938	21
Hall, Asaph	Oct. 15, 1829	1875	Nov. 22, 1907	6
Hall, Edwin Herbert	Nov. 7, 1855	1911	Nov. 20, 1938	21
Hall, G. Stanley	Feb. 1, 1846	1915	Apr. 24, 1924	12
Hall, James	Sept. 12, 1811	(1)	Aug. 7, 1898	(5)
Hallowell, Alfred Irving	Dec. 28, 1892	1961	Oct. 10, 1974	..
Halsted, W. S.	Sept. 23, 1852	1917	Sept. 7, 1922	17
Hansen, William Webster	May 27, 1909	1949	May 23, 1949	27
Harkins, William Draper	Dec. 28, 1873	1921	Mar. 7, 1951	..
Harned, Herbert Spencer	Dec. 2, 1888	1950	July 29, 1969	..
Harper, Robert Almer	Jan. 21, 1862	1911	May 12, 1946	25
Harrison, Ross Granville	Jan. 13, 1870	1913	Sept. 30, 1959	35
Hart, Edwin Bret	Dec. 25, 1874	1944	Mar. 12, 1953	28
Hartman, Carl Gottfried	June 3, 1879	1937	Mar. 1, 1968	..
Harvey, Edmund Newton	Nov. 25, 1887	1934	July 21, 1959	39
Hassid, William Zev	Oct. 1, 1897	1958	Apr. 28, 1974	..
Hastings, Charles Sheldon	Nov. 27, 1848	1889	Jan. 29, 1932	20
Hauser, Charles Roy	Mar. 8, 1900	1958	Jan. 6, 1970	..
Hayden, F. V.	Sept. 7, 1829	1873	Dec. 22, 1887	3
Hayford, John Fillmore	May 19, 1868	1911	Mar. 10, 1925	16
Hecht, Selig	Feb. 8, 1892	1944	Sept. 18, 1947	..
Hektoen, Ludvig	July 2, 1863	1918	July 5, 1951	28
Henderson, Lawrence Joseph	June 3, 1878	1919	Feb. 10, 1942	23
Henderson, Yandell	Apr. 23, 1873	1923	Feb. 18, 1944	..
Henry, Joseph [4]	Dec. 17, 1797	(1)	May 13, 1878	5
Henyey, Louis George	Feb. 3, 1910	1968	Feb. 18, 1970	..
Herrick, Charles Judson	Oct. 6, 1868	1918	Jan. 29, 1960	43
Herskovits, Melville Jean	Sept. 10, 1895	1959	Feb. 25, 1963	42
Herty, Charles Holmes, Jr.	Oct. 6, 1896	1947	Jan. 17, 1953	31
Hess, Harry Hammond	May 24, 1906	1952	Aug. 26, 1969	43
Hewett, Donnel Foster	June 24, 1881	1937	Feb. 5, 1971	44
Hibbert, Harold	Aug. 27, 1877	1945	May 13, 1945	32
Hilgard, Eugene W.	Jan. 5, 1833	1872	Jan. 8, 1916	9
Hilgard, Julius Erasmus	Jan. 7, 1825	(1)	May 8, 1891	3
Hill, George William	Mar. 3, 1838	1874	Apr. 16, 1914	8
Hill, Henry B.	Apr. 27, 1849	1883	Apr. 6, 1903	5

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DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Hillebrand, William F.	Dec. 12, 1853	1908	Feb. 7, 1925	12
Hisaw, Frederick Lee	Aug. 23, 1891	1947	Dec. 3, 1972	--
Hitchcock, Edward	May 24, 1793	(1)	Feb. 27, 1864	1
Hoagland, Dennis Robert	Apr. 2, 1884	1934	Sept. 5, 1949	29
Holbrook, J. E.	Dec. 30, 1794	1868	Sept. 8, 1871	5
Holden, Edward Singleton	Nov. 5, 1846	1885	Mar. 16, 1914	8
Holmes, William Henry	Dec. 1, 1846	1905	Apr. 20, 1933	17
Hooton, Earnest Albert	Nov. 20, 1887	1935	May 3, 1954	--
Hoover, Herbert	Aug. 10, 1874	1922	Oct. 20, 1964	39
Horsfall, Frank Lappin, Jr.	Dec. 14, 1906	1948	Feb. 19, 1971	--
Hotelling, Harold	Sept. 29, 1895	1970	Dec. 26, 1973	--
Houston, William Vermillion	Jan. 19, 1900	1943	Aug. 20, 1968	44
Hovgaard, William	Nov. 28, 1857	1929	Jan. 5, 1950	36
Hovland, Carl Iver	June 12, 1912	1960	Apr. 16, 1961	--
Howard, Leland Ossian	June 11, 1857	1916	May 1, 1950	33
Howe, H. M.	Mar. 2, 1848	1917	May 14, 1922	[2] 21
Howe, Marshall Avery	June 6, 1867	1923	Dec. 24, 1936	19
Howell, William Henry	Feb. 20, 1860	1905	Feb. 6, 1945	26
Hrdlicka, Ales	Mar. 29, 1869	1921	Sept. 5, 1943	23
Hubbard, J. S.	Sept. 7, 1823	(1)	Aug. 16, 1863	1
Hubble, Edwin Powell	Nov. 20, 1889	1927	Sept. 28, 1953	41
Hudson, Claude Silbert	Jan. 26, 1881	1927	Dec. 27, 1952	32
Hulett, George Augustus	July 15, 1867	1922	Sept. 6, 1955	34
Hull, Albert Wallace	Apr. 10, 1880	1939	Jan. 22, 1966	41
Hull, Clark Leonard	May 24, 1884	1936	May 10, 1952	33
Humphreys, A. A.	Nov. 2, 1810	(1)	Dec. 27, 1883	2
Hunt, Reid	Apr. 20, 1870	1919	Mar. 10, 1948	26
Hunt, T. Sterry	Sept. 5, 1826	1873	Feb. 12, 1892	15
Hunter, Walter Samuel	Mar. 22, 1889	1935	Aug. 4, 1954	31
Huntington, George Sumner	Mar. 21, 1861	1924	Jan. 5, 1927	18
Hyatt, Alpheus	Apr. 5, 1838	1875	Jan. 15, 1902	6
Hyman, Libbie Henrietta	Dec. 6, 1888	1961	Aug. 3, 1969	--
Iddings, Joseph Paxson	Jan. 21, 1857	1907	Sept. 8, 1920	--
Ipatieff, Vladimir Nikolaevich	Nov. 22, 1867	1939	Nov. 29, 1952	--
Iselin, Columbus O'Donnell	Sept. 25, 1904	1951	Jan. 5, 1971	--
Ives, Herbert Eugene	July 31, 1882	1933	Nov. 13, 1953	29
Jackson, Charles Loring	Apr. 4, 1847	1883	Oct. 28, 1935	37
Jackson, Dunham	July 24, 1888	1935	Nov. 6, 1946	33
Jacobs, Merkel Henry	Dec. 6, 1884	1939	June 27, 1970	--
Jacobs, Walter Abraham	Dec. 24, 1883	1932	July 12, 1967	--
James, William [7]	Jan. 11, 1842	1903	Aug. 26, 1910	--
Jeffries, Zay	Apr. 22, 1888	1939	May 21, 1965	--
Jennings, Herbert Spencer	Apr. 8, 1868	1914	Apr. 14, 1947	--
Jewett, Frank Baldwin	Sept. 5, 1879	1918	Nov. 18, 1949	27
Johnson, Douglas Wilson	Nov. 30, 1878	1932	Feb. 24, 1944	24
Johnson, S. W.	July 3, 1830	1866	July 21, 1909	7
Johnson, Treat Baldwin	Mar. 29, 1875	1919	July 28, 1947	27
Jones, Donald Forsha	Apr. 16, 1890	1939	June 10, 1963	46
Jones, Lewis Ralph	Dec. 5, 1864	1920	Apr. 1, 1945	31
Jones, Walter	Apr. 28, 1865	1918	Feb. 28, 1935	20
Jordan, Edwin Oakes	July 28, 1866	1936	Sept. 2, 1936	20
Joy, Alfred Harrison	Sept. 23, 1882	1944	Apr. 18, 1973	46
Julian, Percy Lavon	April 11, 1899	1973	Apr. 19, 1975	--
Kasner, Edward	Apr. 2, 1878	1917	Jan. 7, 1955	31
Kaufmann, Berwind Petersen	Apr. 23, 1897	1952	Sept. 12, 1975	--
Keeler, J. E.	Sept. 10, 1857	1900	Aug. 12, 1900	5
Keith, Arthur	Sept. 30, 1864	1928	Feb. 7, 1944	29
Kelley, Walter Pearson	Feb. 19, 1878	1943	May 19, 1965	40
Kellogg, Arthur Remington	Apr. 2, 1900	1950	June 20, 1969	46
Kellogg, Vernon Lyman	Dec. 1, 1867	1930	Aug. 8, 1937	20
Kelly, Mervin J.	Feb. 14, 1894	1945	Mar. 18, 1971	--
Kelser, Raymond Alexander	Dec. 2, 1892	1948	Apr. 16, 1952	28
Kemp, James Furman	Aug. 14, 1859	1911	Nov. 17, 1926	16
Kendall, Edward Calvin	Mar. 8, 1886	1950	May 4, 1972	--
Kennelly, Arthur Edwin	Dec. 17, 1861	1921	June 18, 1939	22
Kent, Robert Harrington	July 1, 1876	1951	Feb. 3, 1961	42
Kettering, Charles Franklin	Aug. 29, 1876	1928	Nov. 25, 1958	34
Kharasch, Morris Selig	Aug. 24, 1895	1946	Oct. 9, 1957	34
Kidder, Alfred Vincent	Oct. 29, 1885	1936	June 11, 1963	39
Kimball, George Elbert	July 12, 1906	1954	Dec. 6, 1967	43
King, Arthur Scott	Jan. 18, 1876	1941	Apr. 25, 1957	--
King, Clarence	Jan. 6, 1842	1876	Dec. 24, 1901	6
Kirkwood, John Gamble	May 30, 1907	1942	Aug. 9, 1959	--
Kirtland, Jared P.	Nov. 10, 1793	1865	Dec. 10, 1877	2
Kluckhohn, Clyde Kay Maben	Jan. 11, 1905	1952	July 29, 1960	37
Knopf, Adolph	Dec. 2, 1882	1931	Nov. 24, 1966	41
Kofoid, Charles Atwood	Oct. 11, 1865	1922	May 30, 1947	26
Kohler, Elmer Peter	Nov. 6, 1865	1920	May 24, 1938	27
Köhler, Wolfgang	Jan. 21, 1887	1947	June 11, 1967	--
Kraus, Charles August	Aug. 15, 1875	1925	June 27, 1967	42
Kroeber, Alfred Louis	June 11, 1876	1928	Oct. 5, 1960	36
Kuiper, Gerard Peter	Dec. 7, 1905	1950	Dec. 23, 1973	--

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Kunkel, Louis Otto	May 7, 1884	1932	Mar. 20, 1960	38
Lamb, Arthur Becket	Feb. 25, 1880	1924	May 15, 1952	29
Lambert, Walter Davis	Jan. 12, 1879	1949	Oct. 27, 1968	43
La Mer, Victor Kuhn	June 15, 1895	1945	Sept. 26, 1966	45
Laporte, Otto	July 23, 1902	1971	Mar. 28, 1971	..
Landsteiner, Karl	June 14, 1868	1932	June 26, 1943	40
Lane, J. Homer	Aug. 9, 1819	1872	May 3, 1880	3
Langley, Samuel P.	Aug. 22, 1834	1876	Feb. 27, 1906	7
Langmuir, Irving	Jan. 31, 1881	1918	Aug. 16, 1957	45
Larsen, Esper Signius, Jr.	Mar. 14, 1879	1944	Mar. 8, 1961	37
Lashley, Karl Spencer	June 7, 1890	1930	Aug. 7, 1958	35
Latimer, Wendell Mitchell	Apr. 22, 1893	1940	July 6, 1955	32
Laufer, Berthold	Oct. 11, 1874	1930	Sept. 13, 1934	18
Lauritsen, Charles Christian	Apr. 4, 1892	1941	Apr. 13, 1968	46
Lauritsen, Thomas	Nov. 16, 1915	1969	Oct. 16, 1973	..
Lawrence, Ernest Orlando	Aug. 8, 1901	1934	Aug. 27, 1958	41
Lawson, Andrew Cowper	July 25, 1861	1924	June 16, 1952	37
Lea, Matthew Carey	Aug. 18, 1823	1892	Mar. 15, 1897	5
Le Conte, John	Dec. 4, 1818	1878	Apr. 29, 1891	3
Le Conte, John L.	May 13, 1825	(1)	Nov. 15, 1883	2
Le Conte, Joseph	Feb. 26, 1823	1875	July 6, 1901	6
Lefschetz, Solomon	Sept. 3, 1884	1925	Oct. 5, 1972	..
Lehrman, Daniel Sanford	June 1, 1919	1970	Aug. 29, 1972	..
Leidy, Joseph	Sept. 9, 1823	(1)	Apr. 30, 1891	7
Leith, Charles Kenneth	Jan. 20, 1875	1920	Sept. 13, 1956	33
Lesley, J. Peter	Sept. 17, 1819	(1)	June 1, 1903	8
Lesquereux, Leo	Nov. 18, 1806	1864	Oct. 25, 1889	3
Leuschner, Armin Otto	Jan. 16, 1868	1913	Apr. 22, 1953	49
Levene, Phoebus Aaron Theodor	Feb. 25, 1869	1916	Sept. 6, 1940	23
Leverett, Frank	Mar. 10, 1859	1929	Nov. 15, 1943	23
Levinson, Norman	Aug. 11, 1912	1967	Oct 10, 1975	..
Lewis, George William	Mar. 10, 1882	1945	July 12, 1948	25
Lewis, Gilbert Newton [3]	Oct. 23, 1875	1913	Mar. 23, 1946	31
Lewis, Howard Bishop	Nov. 8, 1887	1949	Mar. 7, 1954	44
Lewis, Warren Harmon	June 17, 1870	1936	July 3, 1964	39
Lewis, Warren Kendall	Aug. 21, 1882	1938	Mar. 8, 1975	..
Lillie, Frank Rattray	July 27, 1870	1915	Nov. 5, 1947	30
Lim, Robert Kho-Seng [3]	Oct. 15, 1897	1965	July 8, 1969	..
Lind, Samuel Colville	June 15, 1879	1930	Feb. 12, 1965	..
Lindgren, Waldemar	Feb. 14, 1860	1909	Nov. 3, 1939	..
Linton, Ralph	Feb. 27, 1893	1945	Dec. 24, 1953	31
Little, Clarence Cook	Oct. 6, 1888	1945	Dec. 22, 1971	46
Loeb, Jacques	Apr. 7, 1859	1910	Feb. 11, 1924	13
Loeb, Leo	Sept. 21, 1869	1937	Dec. 28, 1959	35
Loeb, Robert Frederick	Mar. 14, 1895	1946	Oct. 21, 1973	49
Long, Cyril Norman Hugh	June 19, 1901	1948	July 6, 1970	46
Longcope, Warfield Theobald	Mar. 29, 1877	1943	Apr. 25, 1953	33
Longstreth, Miers F.	Mar. 15, 1819	(1)	Dec. 27, 1891	8
Longwell, Chester Ray	Oct. 15, 1887	1935	Dec. 15, 1975	..
Loomis, Alfred Lee	Nov. 4, 1887	1941	Aug. 11, 1975	..
Loomis, Elias	Aug. 7, 1811	1873	Aug. 15, 1889	3
Loomis, Francis Wheeler	Aug. 4, 1889	1949	Feb. 9, 1976	..
Lothrop, Samuel Kirkland	July 6, 1892	1951	Jan. 10, 1965	48
Lovering, Joseph	Dec. 25, 1813	1873	Jan. 18, 1892	6
Lowie, Robert Harry	June 12, 1883	1931	Sept. 21, 1957	44
Lucas, Howard Johnson	Mar. 7, 1885	1957	June 22, 1963	43
Lusk, Graham	Feb. 15, 1866	1915	July 8, 1932	21
Lyman, Theodore	Aug. 23, 1833	1872	Sept. 9, 1897	5
Lyman, Theodore	Nov. 23, 1874	1917	Oct. 11, 1954	30
MacArthur, Robert Helmer	Apr. 7, 1930	1969	Nov. 1, 1972	..
MacCallum, William George	Apr. 18, 1874	1921	Feb. 3, 1944	23
MacInnes, Duncan Arthur	Mar. 31, 1885	1937	Sept. 23, 1965	41
Mackin, Joseph Hoover	Nov. 16, 1905	1963	Aug. 12, 1968	45
MacLeod, Colin Munro	Jan. 28, 1909	1955	Feb. 12, 1972	..
MacNider, William de Berniere	June 25, 1881	1938	May 31, 1951	32
Macelwane, James Bernard, S. J.	Sept. 28, 1883	1944	Feb. 15, 1956	31
Mahan, D. H.	Apr. 2, 1802	(1)	Sept. 16, 1871	2
Mall, Franklin P.	Sept. 28, 1862	1907	Nov. 17, 1917	16
Mann, Frank Charles	Sept. 11, 1887	1950	Sept. 30, 1962	38
Mark, Edward Laurens	May 30, 1847	1903	Dec. 16, 1946	..
Marsh, G. P.	Mar. 15, 1801	1866	July 23, 1882	6
Marsh, O. C.	Oct. 29, 1831	1874	Mar. 18, 1899	20
Marshall, Eli Kennerly, Jr.	May 2, 1889	1943	Jan. 10, 1966	..
Mason, Max	Oct. 26, 1877	1923	Mar. 22, 1961	37
Maxcy, Kenneth Fuller	July 27, 1889	1950	Dec. 12, 1966	42
Mayer, Alfred M.	Nov. 13, 1836	1872	July 13, 1897	8
Mayer, Maria Goeppert	June 28, 1906	1956	Feb. 20, 1972	..
Maynard, Leonard Amby	Nov. 8, 1887	1944	June 22, 1972	..
Mayor, A. G.	Apr. 16, 1868	1916	June 25, 1922	[2] 21
Mayo-Smith, Richmond	Feb. 9, 1854	1890	Nov. 11, 1901	[2] 17
McClung, Clarence Erwin	Apr. 5, 1870	1920	Jan. 17, 1946	..
McCollum, Elmer Verner	Mar. 3, 1879	1920	Nov. 15, 1967	45

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
McElvain, Samuel Marion	Dec. 9, 1897	1949	Apr. 11, 1973	--
McMaster, Philip Duryeé	Sept. 14, 1891	1952	Mar. 20, 1973	--
McMath, Robert Raynolds	May 11, 1891	1958	Jan. 2, 1962	49
Mead, Warren Judson	Aug. 5, 1883	1939	Jan. 16, 1960	35
Meek, F. B.	Dec. 10, 1817	1869	Dec. 21, 1876	4
Meek, Walter Joseph	Aug. 15, 1878	1947	Feb. 15, 1963	--
Mees, Charles Edward Kenneth	May 26, 1882	1950	Aug. 15, 1960	42
Meggers, William Frederick	July 13, 1888	1954	Nov. 19, 1966	41
Mehl, Robert Franklin	Mar. 30, 1898	1958	Jan. 29, 1976	--
Meigs, M. C.	May 3, 1816	1865	Jan. 2, 1892	3
Meltzer, Samuel James	Mar. 22, 1851	1912	Nov. 8, 1920	[2]21
Mendel, Lafayette Benedict	Feb. 5, 1872	1913	Dec. 9, 1935	18
Mendenhall, Charles Elwood	Aug. 1, 1872	1918	Aug. 18, 1935	18
Mendenhall, T. C.	Oct. 4, 1841	1887	Mar. 22, 1924	16
Mendenhall, Walter Curran	Feb. 20, 1871	1932	June 2, 1957	46
Merica, Paul Dyer	Mar. 17, 1889	1942	Oct. 20, 1957	33
Merriam, Clinton Hart	Dec. 5, 1855	1902	Mar. 19, 1942	24
Merriam, John Campbell	Oct. 20, 1869	1918	Oct. 30, 1945	26
Merrill, Elmer Drew	Oct. 15, 1876	1923	Feb. 25, 1956	32
Merrill, George Perkins	May 31, 1854	1922	Aug. 15, 1929	17
Merrill, Paul Willard	Aug. 15, 1887	1929	July 19, 1961	37
Merritt, Ernest George	Apr. 28, 1865	1914	June 5, 1948	--
Metz, Charles William	Feb. 17, 1889	1948	Feb. 25, 1975	--
Meyer, Karl Friedrich	May 19, 1884	1940	Apr. 27, 1974	--
Meyerhof, Otto	Apr. 12, 1884	1949	Oct. 6, 1951	34
Michael, Arthur	Aug. 7, 1853	1889	Feb. 8, 1942	46
Michaelis, Leonor	Jan. 16, 1875	1943	Oct. 8, 1949	31
Michelson, A. A.	Dec. 19, 1852	1888	May 9, 1931	19
Midgley, Thomas, Jr.	May 18, 1889	1942	Nov. 2, 1944	24
Miller, Alden Holmes	Feb. 4, 1906	1957	Oct. 9, 1965	43
Miller, Dayton Clarence	Mar. 13, 1866	1921	Feb. 22, 1941	23
Miller, George Abram	July 31, 1863	1921	Feb. 10, 1951	30
Millikan, Clark Blanchard	Aug. 23, 1903	1964	Jan. 2, 1966	40
Millikan, Robert Andrews	Mar. 22, 1868	1915	Dec. 19, 1953	33
Minkowski, Rudolph, Leo	May 28, 1895	1959	Jan. 4, 1976	--
Minot, Charles Sedgwick	Dec. 23, 1852	1897	Nov. 19, 1914	9
Minot, George Richards	Dec. 2, 1885	1937	Feb. 25, 1950	45
Mirsky, Alfred Ezra	Oct. 17, 1900	1954	June 19, 1974	--
Mitchell, Henry	Sept. 16, 1830	1885	Dec. 1, 1902	20
Mitchell, Samuel Alfred	Apr. 29, 1874	1933	Feb. 22, 1960	36
Mitchell, Silas Weir	Feb. 15, 1829	1865	Jan. 4, 1914	32
Modjeski, Ralph	Jan. 27, 1861	1925	June 26, 1940	23
Moore, Carl Richard	Dec. 5, 1892	1944	Oct. 16, 1955	45
Moore, Carl Vernon	Aug. 21, 1908	1970	Aug. 13, 1972	--
Moore, Eliakim Hastings	Jan. 26, 1862	1901	Dec. 30, 1932	17
Moore, Joseph Haines	Sept. 7, 1878	1931	Mar. 16, 1949	29
Moore, Robert Lee	Nov. 14, 1882	1931	Oct. 4, 1974	--
Morgan, Lewis H.	Nov. 21, 1818	1875	Dec. 17, 1881	6
Morgan, Thomas Hunt	Sept. 25, 1866	1909	Dec. 4, 1945	33
Morley, E. W.	Jan. 29, 1838	1897	Feb. 24, 1923	[2]21
Morse, Edward Sylvester	June 18, 1838	1876	Dec. 20, 1925	17
Morse, Harmon N.	Oct. 15, 1848	1907	Sept. 8, 1920	[2]21
Morton, Henry	Dec. 11, 1836	1874	May 9, 1902	8
Moulton, Forest Ray	Apr. 29, 1872	1910	Dec. 7, 1952	--
Mueller, John Howard	June 13, 1891	1945	Feb. 16, 1954	--
Muller, Hermann Joseph	Dec. 21, 1890	1931	Apr. 5, 1967	--
Murnaghan, Francis Dominic	Aug. 4, 1893	1942	Mar. 24, 1976	--
Murphree, Eger Vaughan	Nov. 3, 1898	1950	Oct. 29, 1962	40
Murphy, James Bumgardner	Aug. 4, 1884	1940	Aug. 24, 1950	34
Nef, John Ulric	June 14, 1862	1904	Aug. 13, 1915	34
Newberry, J. S.	Dec. 22, 1822	(1)	Dec. 7, 1892	6
Newcomb, Simon	Mar. 12, 1835	1869	July 11, 1909	17
Newton, H. A.	Mar. 19, 1830	(1)	Aug. 12, 1896	4
Newton, John	Aug. 24, 1823	1876	May 1, 1895	4
Nicholas, John Spangler	Mar. 18, 1895	1949	Sept. 11, 1963	40
Nichols, Edward Leamington	Sept. 14, 1854	1901	Nov. 10, 1937	21
Nichols, Ernest Fox	June 1, 1869	1908	Apr. 29, 1924	12
Nicholson, Seth Barnes	Nov. 12, 1891	1937	July 2, 1963	42
Niemann, Carl George	July 6, 1908	1952	Apr. 29, 1964	40
Nissen, Henry W.	Feb. 5, 1901	1953	Apr. 27, 1958	38
Norris, James Flack	Jan. 20, 1871	1934	Aug. 3, 1940	45
Norton, William A.	Oct. 25, 1810	1873	Sept. 21, 1883	2
Novy, Frederick George	Dec. 9, 1864	1924	Aug. 8, 1957	33
Noyes, Arthur Amos	Sept. 13, 1866	1905	June 3, 1936	31
Noyes, William Albert	Nov. 6, 1857	1910	Oct. 24, 1941	27
Oliver, James E.	July 27, 1829	1872	Mar. 27, 1895	4
Opie, Eugene Lindsay	July 5, 1873	1923	Mar. 12, 1971	--
Oppenheimer, J. Robert	Apr. 22, 1904	1941	Feb. 18, 1967	--
Osborn, Henry Fairfield	Aug. 8, 1857	1900	Nov. 6, 1935	19
Osborne, Thomas Burr	Aug. 5, 1859	1910	Jan. 29, 1929	14
Osgood, William Fogg	Mar. 10, 1864	1904	July 22, 1943	--
Osterhout, Winthrop John Vanleuven	Aug. 2, 1871	1919	Apr. 9, 1964	44

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DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Packard, Alpheus Spring	Feb. 19, 1839	1872	Feb. 14, 1905	9
Painter, Theophilus Shickel	Aug. 22, 1889	1938	Oct. 5, 1969	..
Palache, Charles	July 18, 1869	1934	Dec. 5, 1954	30
Parker, George Howard	Dec. 23, 1864	1913	Mar. 26, 1955	39
Patterson, John Thomas	Nov. 3, 1878	1941	Dec. 4, 1960	38
Paul, John Rodman	Apr. 18, 1893	1945	May 6, 1971	..
Pearl, Raymond	June 3, 1879	1916	Nov. 17, 1940	22
Pecora, William Thomas	Feb. 1, 1913	1965	July 19, 1972	..
Pegram, George Braxton	Oct. 24, 1876	1949	Aug. 12, 1958	14
Peirce, Benjamin [11]	Apr. 4, 1809	(1)	Oct. 6, 1880	..
Peirce, Benjamin Osgood	Feb. 11, 1854	1906	Jan. 14, 1914	8
Peirce, Charles S. S.	Sept. 10, 1839	1877	Apr. 20, 1914	..
Penfield, Samuel L.	Jan. 16, 1856	1900	Aug. 13, 1906	6
Peters, C. H. F.	Sept. 19, 1813	1876	July 18, 1890	..
Peters, John Punnett	Dec. 4, 1887	1947	Dec. 29, 1955	31
Petrunkevitch, Alexander	Dec. 22, 1875	1954	Mar. 9, 1964	..
Pickering, Edward C.	July 19, 1846	1873	Feb. 3, 1919	15
Pierce, George Washington	Jan. 11, 1872	1920	Aug. 25, 1956	33
Piggot, Charles Snowden	June 5, 1892	1946	July 6, 1973	..
Pillsbury, Walter Bowers	July 21, 1872	1925	June 3, 1960	37
Pincus, Gregory Goodwin	Apr. 9, 1903	1965	Aug. 22, 1967	42
Pirsson, Louis V.	Nov. 3, 1860	1913	Dec. 8, 1919	34
Pourtalès, L. F.	Mar. 4, 1824	1873	July 19, 1880	5
Powell, John W.	Mar. 24, 1834	1880	Sept. 23, 1902	8
Power, Frederick Belding	Mar. 4, 1853	1924	Mar. 26, 1927	..
Prudden, T. Mitchell	July 7, 1849	1901	Apr. 10, 1924	12
Pumpelly, Raphael	Sept. 8, 1837	1872	Aug. 10, 1923	16
Pupin, Michael Idvorsky	Oct. 4, 1858	1905	Mar. 12, 1935	19
Putnam, Frederic Ward	Apr. 16, 1839	1885	Aug. 14, 1915	16
Ransome, Frederick Leslie	Dec. 2, 1868	1914	Oct. 6, 1935	22
Ranson, Stephen Walter	Aug. 28, 1880	1940	Aug. 30, 1942	23
Raper, John Robert	Oct. 3, 1911	1964	May 21, 1974	..
Reeside, John Bernard, Jr.	June 24, 1889	1945	July 2, 1958	35
Reid, Harry Fielding	May 18, 1859	1912	June 18, 1944	26
Remsen, Ira	Feb. 10, 1846	1882	Mar. 4, 1927	14
Rich, Arnold Rice	Mar. 28, 1893	1954	Apr. 17, 1968	..
Richards, Alfred Newton	Mar. 22, 1876	1927	Mar. 24, 1966	42
Richards, Dickinson W.	Oct. 30, 1895	1958	Feb. 23, 1973	..
Richards, Theodore William	Jan. 31, 1868	1899	Apr. 2, 1928	44
Richtmyer, Floyd Karker	Oct. 12, 1881	1932	Nov. 7, 1939	22
Riddle, Oscar	Sept. 27, 1877	1939	Nov. 29, 1968	45
Ridgway, Robert	July 2, 1850	1917	Mar. 25, 1929	15
Ritt, Joseph Fels	Aug. 23, 1893	1933	Jan. 5, 1951	29
Rittenberg, David	Nov. 11, 1906	1953	Jan. 24, 1970	..
Rivers, Thomas Milton	Sept. 3, 1888	1934	May 12, 1962	38
Robertson, Howard Percy	Jan. 27, 1903	1951	Aug. 26, 1961	..
Robertson, Oswald Hope	June 2, 1886	1943	Mar. 23, 1966	42
Robinson, Abraham	Oct. 6, 1918	1974	Apr. 11, 1974	..
Robinson, Benjamin Lincoln	Nov. 8, 1864	1921	July 27, 1935	17
Rodebush, Worth Huff	May 24, 1887	1938	Aug. 16, 1959	36
Rodgers, John	Aug. 8, 1812	(1)	May 5, 1882	6
Rogers, Fairman	Nov. 15, 1883	(1)	Aug. 22, 1900	6
Rogers, Robert E.	Mar. 29, 1813	(1)	Sept. 6, 1884	5
Rogers, William A.	Nov. 13, 1832	1885	Mar. 1, 1898	4, 6
Rogers, William B.	Dec. 7, 1804	(1)	May 30, 1882	3
Romer, Alfred Sherwood	Dec. 28, 1894	1944	Nov. 5, 1973	..
Rood, Ogden N.	Feb. 3, 1831	1865	Nov. 12, 1902	6
Rosa, E. B.	Oct. 4, 1861	1913	May 17, 1921	16
Ross, Frank Elmore	Apr. 2, 1874	1930	Sept. 21, 1960	39
Rossby, Carl-Gustaf Arvid	Dec. 8, 1898	1943	Aug. 19, 1957	34
Rous, Francis Peyton	Oct. 5, 1879	1927	Feb. 16, 1970	48
Rowland, Henry A.	Nov. 27, 1848	1881	Apr. 16, 1901	5
Royce, Josiah	Nov. 20, 1855	1906	Sept. 14, 1916	33
Rubey, William Walden	Dec. 19, 1898	1945	Apr. 12, 1974	49
Ruedemann, Rudolph	Oct. 16, 1864	1928	June 18, 1956	44
Russell, Henry Norris	Oct. 25, 1877	1918	Feb. 18, 1957	32
Russell, Richard Joel	Nov. 16, 1895	1959	Sept. 17, 1971	46
Rutherford, Lewis M.	Nov. 25, 1816	(1)	May 30, 1892	3
Ryan, Harris Joseph	Jan. 8, 1866	1920	July 3, 1934	19
Sabin, Florence Rena	Nov. 9, 1871	1925	Oct. 3, 1953	34
Sabine, Wallace C. W.	June 13, 1868	1917	Jan. 10, 1919	[2] 21
St. John, Charles Edward	Mar. 15, 1857	1924	Apr. 26, 1935	18
Sapir, Edward	Jan. 26, 1884	1934	Feb. 4, 1939	..
Sargent, Charles Sprague	Apr. 24, 1841	1895	Mar. 22, 1927	12
Saunders, Frederick Albert	Aug. 18, 1875	1925	June 9, 1963	39
Sauveur, Albert	June 21, 1863	1927	Jan. 26, 1939	22
Savage, John Lucian	Dec. 25, 1879	1949	Dec. 28, 1967	..
Sax, Karl	Nov. 2, 1892	1941	Oct. 8, 1973	..
Saxton, Joseph	Mar. 22, 1799	(1)	Oct. 26, 1873	1
Scatchard, George	Mar. 19, 1892	1946	Dec. 10, 1973	..
Schairer, John Frank	Apr. 13, 1904	1953	Sept. 26, 1970	..
Schiff, Leonard Isaac	Mar. 29, 1915	1957	Jan. 19, 1971	..

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DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Schlesinger, Frank	May 11, 1871	1916	July 10, 1943	24
Schlesinger, Hermann Irving	Oct. 11, 1882	1948	Oct. 3, 1960	--
Schmidt, Karl Patterson	June 19, 1890	1956	Sept. 26, 1957	--
Schott, Charles A.	Aug. 7, 1826	1872	July 31, 1901	8
Schrader, Frans	Mar. 11, 1891	1951	Mar. 22, 1962	--
Schuchert, Charles	July 3, 1858	1910	Nov. 20, 1942	27
Schultz, Jack	May 7, 1904	1969	Apr. 29, 1971	--
Scott, William Berryman	Feb. 12, 1858	1906	Mar. 29, 1947	25
Scudder, Samuel H.	Apr. 13, 1837	1877	May 17, 1911	[2] 17
Seares, Frederick Hanley	May 17, 1873	1919	July 20, 1964	39
Seashore, Carl Emil	Jan. 28, 1866	1922	Oct. 16, 1949	29
Sellers, William	Sept. 19, 1824	1873	Jan. 24, 1905	--
Setchell, William Albert	Apr. 15, 1864	1919	Apr. 14, 1943	23
Shaffer, Philip Anderson	Sept. 20, 1881	1928	Dec. 4, 1960	40
Shapley, Harlow	Nov. 2, 1885	1924	Oct. 20, 1972	48
Sherman, Henry Clapp	Oct. 16, 1875	1933	Oct. 7, 1955	46
Sherwood, Thomas Kilgore	July 25, 1903	1958	Jan. 14, 1976	--
Shope, Richard Edwin	Dec. 25, 1901	1940	Oct. 2, 1967	--
Silliman, Benjamin, Sr.	Aug. 8, 1779	(1)	Nov. 24, 1864	1
Silliman, Benjamin, Jr.	Dec. 4, 1816	(1)	Jan. 14, 1885	7
Sinnott, Edmund Ware	Feb. 5, 1888	1936	Jan. 6, 1968	--
Slepian, Joseph	Feb. 11, 1891	1941	Dec. 19, 1969	--
Slipher, Vesto Melvin	Nov. 11, 1875	1921	Nov. 8, 1969	--
Smadel, Joseph Edwin	Jan. 10, 1907	1957	July 21, 1963	--
Small, Lyndon Frederick	Aug. 16, 1897	1941	June 15, 1947	33
Smith, Alexander	Sept. 11, 1865	1915	Sept. 8, 1922	[2] 21
Smith, Edgar Fahs	May 23, 1856	1899	May 3, 1928	17
Smith, Erwin Frink	Jan. 21, 1854	1913	Apr. 6, 1927	21
Smith, Gilbert Morgan	Jan. 6, 1885	1948	July 11, 1959	36
Smith, Homer William	Jan. 2, 1895	1945	Mar. 25, 1962	39
Smith, J. Lawrence	Dec. 17, 1818	1872	Oct. 12, 1883	2
Smith, James Perrin	Nov. 27, 1864	1925	Jan. 1, 1931	38
Smith, Lee Irvin	July 22, 1891	1944	Mar. 29, 1973	--
Smith, Philip Edward	Jan. 1, 1884	1939	Dec. 8, 1970	--
Smith, Sidney Irving	Feb. 18, 1843	1884	May 6, 1926	14
Smith, Theobald	July 31, 1859	1908	Dec. 10, 1934	17
Spence, Kenneth Wartinbe	May 6, 1907	1955	Jan. 12, 1967	--
Sperry, Elmer Ambrose	Oct. 12, 1860	1925	June 16, 1930	28
Spier, Leslie	Dec. 13, 1893	1946	Dec. 3, 1961	--
Squier, George Owen	Mar. 21, 1865	1919	Mar. 24, 1934	20
Stadie, William Christopher	June 15, 1886	1945	Sept. 11, 1959	--
Stadler, Lewis John	July 6, 1896	1938	May 13, 1954	30
Stanley, William Meredith	Aug. 16, 1904	1941	June 15, 1971	--
Stebbins, Joel	July 30, 1878	1910	Mar. 16, 1966	49
Steenrod, Norman Earl	Apr. 22, 1910	1956	Oct. 14, 1971	--
Steineger, Leonhard	Oct. 30, 1851	1923	Feb. 28, 1943	24
Steinhaus, Edward Arthur	Nov. 7, 1917	1968	Oct. 20, 1969	44
Stern, Otto	Feb. 17, 1888	1945	Aug. 17, 1969	43
Stevens, Stanley Smith	Nov. 4, 1906	1946	Jan. 18, 1973	--
Steward, Julian H.	Jan. 31, 1902	1954	Feb. 6, 1972	--
Stewart, George Walter	Feb. 22, 1876	1938	Aug. 16, 1956	32
Stieglitz, Julius	May 26, 1867	1911	Jan. 10, 1937	21
Stillwell, Lewis Buckley	Mar. 12, 1863	1921	June 19, 1941	34
Stimpson, William	Feb. 14, 1832	1868	May 26, 1872	8
Stock, Chester	Jan. 28, 1892	1948	Dec. 6, 1950	27
Stockard, Charles Rupert	Feb. 27, 1879	1922	Apr. 7, 1939	--
Stone, Calvin Perry	Feb. 28, 1892	1943	Dec. 28, 1954	--
Stone, Wilson Stuart	Oct. 6, 1907	1960	Feb. 27, 1968	--
Story, William Edward	Apr. 29, 1850	1908	Apr. 11, 1930	--
Stratton, George Malcolm	Sept. 26, 1865	1928	Oct. 9, 1957	35
Stratton, Samuel Wesley	July 18, 1861	1917	Oct. 18, 1931	17
Streeter, George Linius	Jan. 12, 1873	1931	July 27, 1948	28
Strong, Theodore	July 26, 1790	(1)	Feb. 1, 1869	2
Struve, Otto	Aug. 12, 1897	1937	Apr. 6, 1963	--
Sturtevant, Alfred Henry	Nov. 21, 1891	1930	Apr. 6, 1970	--
Sullivant, W. S.	Jan. 15, 1803	1872	Apr. 30, 1873	1
Sumner, Francis Bertody	Aug. 1, 1874	1937	Sept. 6, 1945	25
Sumner, James Batcheller	Nov. 19, 1887	1948	Aug. 12, 1955	31
Sutherland, Earl Wilbur, Jr.	Nov. 19, 1915	1966	Mar. 9, 1974	49
Sverdrup, Harald Ulrik [10]	Nov. 15, 1888	1945	Aug. 20, 1957	--
Swain, George Fillmore	Mar. 2, 1857	1923	July 1, 1931	17
Swanton, John Reed	Feb. 19, 1873	1932	May 2, 1958	34
Swasey, Ambrose	Dec. 19, 1846	1922	June 15, 1937	22
Szilard, Leo	Feb. 11, 1898	1961	May 30, 1964	40
Taliaferro, William Hay	Feb. 10, 1895	1940	Dec. 21, 1973	--
Tate, John Torrance	July 28, 1889	1942	May 27, 1950	--
Tatum, Edward Lawrie	Dec. 14, 1909	1952	Nov. 5, 1975	--
Taylor, Charles Vincent	Feb. 8, 1885	1943	Feb. 22, 1946	25
Taylor, David Watson	Mar. 4, 1864	1918	July 28, 1940	22
Tennent, David Hilt	May 28, 1873	1929	Jan. 14, 1941	26
Terman, Lewis Madison	Jan. 15, 1877	1928	Dec. 21, 1956	33
Thaxter, Roland	Aug. 28, 1858	1912	Apr. 22, 1932	17

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir* (vol. no.)
Thom, Charles	Nov. 11, 1872	1937	May 24, 1956	38
Thompson, Thomas Gordon	Nov. 28, 1888	1951	Aug. 10, 1961	43
Thomson, Elihu	Mar. 29, 1853	1907	Mar. 13, 1937	21
Thorndike, Edward Lee	Aug. 31, 1874	1917	Aug. 9, 1949	27
Thurstone, Louis Leon	May 29, 1887	1938	Sept. 29, 1955	30
Tillett, William Smith	July 10, 1892	1951	Apr. 4, 1974	--
Timoshenko, Stephen Prokop	Dec. 23, 1878	1940	May 29, 1972	49
Tolman, Edward Chace	Apr. 14, 1886	1937	Nov. 19, 1959	37
Tolman, Richard Chace	Mar. 4, 1881	1923	Sept. 5, 1948	27
Torrey, John	Aug. 15, 1796	(1)	Mar. 10, 1873	1
Totten, J. G.	Aug. 23, 1788	(1)	Apr. 22, 1864	1
Tozzer, Alfred Marston	July 4, 1877	1942	Oct. 5, 1954	30
Trelease, William	Feb. 22, 1857	1902	Jan. 1, 1945	35
Trowbridge, Augustus	Jan. 2, 1870	1919	Mar. 14, 1934	18
Trowbridge, John	Aug. 5, 1843	1878	Feb. 18, 1923	14
Trowbridge, William P.	May 25, 1828	1872	Aug. 12, 1892	3
Trumbull, James H.	Dec. 20, 1821	1872	Aug. 5, 1897	7
Trumpler, Robert Julius	Oct. 2, 1886	1932	Sept. 10, 1956	--
Tuckerman, Edward	Dec. 7, 1817	1868	Mar. 15, 1886	3
Turner, Richard Baldwin	Oct. 7, 1916	1964	Dec. 22, 1971	--
Twitty, Victor Chandler	Nov. 5, 1901	1940	Mar. 22, 1967	--
Tyzzer, Ernest Edward	Aug. 30, 1875	1942	Apr. 17, 1968	49
Ulrich, Edward Oscar	Feb. 1, 1857	1917	Feb. 22, 1944	24
Van Hise, C. R.	May 29, 1857	1902	Nov. 19, 1948	17
Van Slyke, Donald Dexter	Mar. 29, 1883	1921	May 4, 1971	48
Van Vleck, Edward Burr	June 7, 1863	1911	June 2, 1943	30
Vaughan, Thomas Wayland	Sept. 20, 1870	1921	Jan. 16, 1952	32
Vaughan, Victor Clarence	Oct. 27, 1851	1915	Nov. 21, 1929	--
Veblen, Oswald	June 24, 1880	1919	Aug. 10, 1960	37
Verrill, Addison E.	Feb. 9, 1839	1872	Dec. 10, 1926	14
Vestine, Ernest Harry	May 8, 1906	1954	July 18, 1968	--
Vinograd, Jerome Rubin	Feb. 9, 1913	1968	July 3, 1976	--
von Békésy, George	June 3, 1899	1956	June 13, 1972	48
von Kármán, Theodore	May 11, 1881	1938	May 7, 1963	38
von Neumann, John	Dec. 28, 1903	1937	Feb. 8, 1957	32
Waksman, Selman Abraham	July 2, 1888	1942	Aug. 16, 1973	--
Walcott, Charles Doolittle	Mar. 31, 1850	1896	Feb. 9, 1927	39
Walker, Francis A.	July 2, 1840	1878	Jan. 5, 1897	5
Walsh, Joseph Leonard	Sept. 21, 1895	1936	Dec. 10, 1973	--
Warren, G. K.	Jan. 8, 1830	1876	Aug. 8, 1882	2
Washburn, Edward Wight	May 10, 1881	1932	Feb. 6, 1934	17
Washburn, Margaret Floy	July 25, 1871	1931	Oct. 29, 1939	25
Washington, Henry Stephens	Jan. 15, 1867	1921	Jan. 7, 1934	--
Watson, James C.	Jan. 28, 1838	1868	Nov. 23, 1880	3
Watson, Sereno	Dec. 1, 1826	1889	Mar. 9, 1892	5
Webster, A. G.	Nov. 28, 1863	1903	May 15, 1923	18
Welch, William Henry	Apr. 8, 1850	1895	Apr. 30, 1934	22
Wells, Harry Gideon	July 21, 1875	1925	Apr. 26, 1943	26
Wells, Horace L.	Oct. 5, 1855	1903	Dec. 19, 1924	12
Werkman, Chester Hamlin	June 17, 1893	1946	Sept. 10, 1962	44
Weyl, Claus Hugo Hermann	Nov. 9, 1885	1940	Dec. 8, 1955	--
Wheeler, Henry Lord	Sept. 14, 1867	1909	Oct. 30, 1914	--
Wheeler, William Morton	Mar. 19, 1865	1912	Apr. 19, 1937	19
Whipple, George Hoyt	Aug. 28, 1878	1929	Feb. 1, 1976	--
White, Charles A.	Jan. 26, 1826	1889	June 29, 1910	7
White, David	July 1, 1862	1912	Feb. 7, 1935	17
White, Henry Seely	May 20, 1861	1915	May 20, 1943	25
Whitehead, John Boswell	Aug. 18, 1872	1932	Nov. 16, 1954	37
Whitman, C. O.	Dec. 14, 1842	1895	Dec. 6, 1910	7
Whitmore, Frank Clifford	Oct. 1, 1887	1946	June 24, 1947	28
Whitney, Josiah D. [11]	Nov. 23, 1819	(1)	Aug. 19, 1896	--
Whitney, William D. [12]	Feb. 9, 1827	1865	June 29, 1894	--
Whitney, Willis Rodney	Aug. 22, 1868	1917	Jan. 9, 1958	34
Whyburn, Gordon Thomas	Jan. 7, 1904	1951	Sept. 8, 1969	--
Wiener, Norbert [13]	Nov. 26, 1894	1934	Mar. 18, 1964	--
Wiggers, Carl John	May 28, 1883	1951	Apr. 28, 1963	48
Wilczynski, Ernest Julius	Nov. 13, 1876	1919	Sept. 14, 1932	16
Williams, John Harry	July 7, 1908	1961	Apr. 18, 1966	42
Williams, Robert R.	Feb. 16, 1886	1945	Oct. 2, 1965	--
Willier, Benjamin Harrison	Nov. 2, 1890	1945	Dec. 3, 1972	--
Willis, Bailey	May 31, 1857	1920	Feb. 19, 1949	35
Williston, Samuel W.	July 10, 1852	1915	Aug. 30, 1918	17
Wilson, David Wright	Jan. 4, 1889	1955	July 13, 1965	43
Wilson, Edmund Beecher	Oct. 19, 1856	1899	Mar. 3, 1939	21
Wilson, Edwin Bidwell	Apr. 25, 1879	1919	Dec. 28, 1964	43
Wilson, Henry Van Peters	Feb. 16, 1863	1927	Jan. 4, 1939	35
Wilson, Ralph Elmer	Apr. 14, 1886	1950	Mar. 25, 1960	36
Wilson, Robert Erastus	Mar. 19, 1893	1947	Sept. 1, 1964	--
Winlock, Joseph	Feb. 6, 1826	(1)	June 11, 1875	1
Winstein, Saul	Oct. 8, 1912	1955	Nov. 23, 1969	43
Wintersteiner, Oskar	Nov. 15, 1898	1950	Aug. 15, 1971	--
Wislocki, George Bernays	Mar. 25, 1892	1941	Oct. 22, 1956	--

See footnotes at end of table.

DECEASED MEMBERS—Continued

	Date of birth	Year of election	Date of death	Memoir[2] (vol. no.)
Wissler, Clark	Sept. 18, 1876	1929	Aug. 25, 1947	--
Wolbach, Simeon Burt	July 3, 1880	1938	Mar. 19, 1954	--
Wolfrom, Melville Lawrence	Apr. 2, 1900	1950	June 20, 1969	--
Wood, Horatio C.	Jan. 13, 1841	1879	Jan. 3, 1920	33
Wood, Robert Williams	May 2, 1868	1912	Aug. 11, 1955	--
Wood, William Barry, Jr.	May 4, 1910	1959	Mar. 9, 1971	--
Woodruff, Lorande Loss	July 14, 1879	1924	June 23, 1947	--
Woodward, J. J.	Oct. 30, 1833	1873	Aug. 17, 1884	2
Woodward, Robert S.	July 21, 1849	1896	June 29, 1924	19
Woodworth, Robert Sessions	Oct. 17, 1869	1921	July 4, 1962	29
Woolley, Dilworth Wayne	July 20, 1914	1952	July 23, 1966	--
Worthen, Amos Henry	Oct. 31, 1813	1872	May 6, 1888	3
Wright, Arthur Williams	Sept. 8, 1836	1881	Dec. 19, 1915	15
Wright, Frederick Eugene	Oct. 16, 1877	1923	Aug. 25, 1953	29
Wright, Orville	Aug. 19, 1871	1936	Jan. 30, 1948	25
Wright, William Hammond	Nov. 4, 1871	1922	May 16, 1959	--
Wyman, Jeffries	Aug. 11, 1814	(1)	Sept. 4, 1874	2
Yerkes, Robert Mearns	May 26, 1876	1923	Feb. 3, 1956	38
Young, Charles A.	Dec. 15, 1834	1872	Jan. 3, 1908	7
Zinsser, Hans	Nov. 17, 1879	1924	Sept. 4, 1940	24

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[1] Charter member, Mar. 3, 1863.
[2] Scientific Memoir Series.
[3] Elected a foreign associate in 1931; naturalized in 1946.
[4] Elected a foreign associate in 1922; naturalized in 1940.
[5] "Life of James Hall," by John M. Clarke, published in book form.
[6] 1797 or 1799. See "Joseph Henry," by Simon Newcomb, in Biographical Memoirs, vol. 5, no. 1, p. 1 (N.A.S., 1905).
[7] Resigned, 1909.
[8] Resigned, 1934.
[9] Elected a foreign associate in 1942; naturalized in 1955.
[10] Resigned Academy membership on Apr. 2, 1951, when he had maintained residence in Norway for 3 years, thereby losing American citizenship. Elected a foreign associate in 1952.
[11] Resigned, 1874.
[12] Resigned, 1882.
[13] Resigned, 1941.

DECEASED FOREIGN ASSOCIATES OF THE NATIONAL ACADEMY OF SCIENCES

March 1863 through June 1976

	Date of birth	Date of election	Date of death
Adams, Frank Dawson	Sept. 17, 1859	1920	Dec. 26, 1942
Adams, John Cough	June 5, 1819	1883	Jan. 22, 1892
Airy, Sir George B.	July 27, 1801	1865	Jan. 4, 1892
Argelander, F. W. A.	Mar. 3, 1799	1864	Feb. 17, 1875
Arrhenius, Svante A.	Feb. 19, 1859	1908	Oct. 2, 1927
Auwers, G. F. J. Arthur	Sept. 12, 1838	1883	Jan. 24, 1915
Backlund, Oskar	Apr. 28, 1846	1903	Aug. 29, 1916
Baer, Karl Ernst von	Feb. 17, 1792	1864	Nov. 28, 1876
Baeyer, Adolf von	Oct. 31, 1835	1898	Aug. 20, 1917
Bailey, Sir Edward	July 1, 1881	1944	Mar. 19, 1965
Barcroft, Sir Joseph	July 26, 1872	1939	Mar. 21, 1947
Barrande, Joachim	Aug. 11, 1799	1867	Oct. 5, 1883
Barrois, Charles	Aug. 21, 1851	1908	Nov. 5, 1939
Bartlett, Sir Frederick Charles	Oct. 20, 1886	1947	Sept. 30, 1969
Bateson, William	Aug. 8, 1861	1921	Feb. 8, 1926
Beaumont, L. Elie de	Sept. 25, 1798	1864	Sept. 21, 1874
Becquerel, Henri	Dec. 15, 1852	1905	Aug. 25, 1908
Berthelot, M. P. E.	Oct. 25, 1827	1883	Mar. 18, 1907
Bertrand, J. L. F.	Mar. 11, 1822	1883	Apr. 3, 1900
Bhabha, Homi Jehangir	Oct. 30, 1909	1963	Jan. 24, 1966
Bjerknes, V. F. K.	Mar. 14, 1862	1934	Apr. 9, 1951
Bjerrum, Niels	Mar. 11, 1879	1952	Sept. 30, 1958
Blackett, P. M. S. Baron	Nov. 18, 1897	1966	July 13, 1974
Bohr, Niels	Oct. 7, 1885	1925	Nov. 18, 1962
Boltzmann, Ludwig	Feb. 20, 1844	1904	Sept. 5, 1906
Bordet, Jules	June 13, 1870	1935	Apr. 6, 1961
Born, Max	Dec. 11, 1882	1955	Jan. 5, 1970
Bornet, Edouard	Sept. 2, 1828	1901	Dec. 18, 1911
Boussingault, J. B. J. D.	Feb. 2, 1802	1883	May 11, 1887
Boveri, Theodor	Oct. 12, 1862	1913	Oct. 15, 1915
Bower, Frederick Orpen	Nov. 4, 1855	1929	Apr. 11, 1948
Bragg, Sir William	July 2, 1862	1939	Mar. 12, 1942
Bragg, Sir William Lawrence	Mar. 31, 1890	1945	July 1, 1971

DECEASED FOREIGN ASSOCIATES—Continued

	Date of birth	Date of election	Date of death
Braun, Alexander	May 10, 1805	1865	Mar. 29, 1877
Brewster, Sir David	Dec. 11, 1781	1864	Feb. 10, 1868
Brogger, Waldemar Christofer	Nov. 10, 1851	1903	Feb. 17, 1940
Bronstead, Johannes Nicolaus	Feb. 22, 1879	1947	Dec. 17, 1947
Bunsen, Robert Wilhelm	Mar. 31, 1811	1864	Aug. 16, 1899
Burmeister, C. H. C.	Jan. 15, 1807	1867	May 2, 1892
Candolle, Alphonse de	Oct. 27, 1806	1883	Apr. 4, 1893
Cartan, Elie	Apr. 9, 1869	1949	May 6, 1951
Caso, Alfonso	Feb. 1, 1896	1943	Nov. 30, 1970
Cayley, Arthur	Aug. 16, 1821	1883	Jan. 26, 1895
Chapman, Sydney	Jan. 29, 1888	1946	June 16, 1970
Chasles, Michel	Nov. 15, 1793	1864	Dec. 18, 1880
Chevreul, Michel Eugène	Aug. 31, 1786	1883	Apr. 9, 1889
Clark, Sir Wilfrid Le Gros	June 5, 1895	1963	June 28, 1971
Clausius, Rudolph	Jan. 2, 1822	1883	Aug. 24, 1888
Cornu, Alfred	Mar. 6, 1841	1901	Apr. 12, 1902
Crookes, Sir William	June 17, 1832	1913	Apr. 1, 1919
Dale, Sir Henry	June 9, 1875	1940	July 22, 1968
Darboux, Gaston	Aug. 13, 1842	1913	Feb. 23, 1917
Darwin, Sir George Howard	July 9, 1845	1904	Dec. 7, 1912
de Sitter, Willem	May 6, 1872	1929	Nov. 21, 1934
Deslandres, Henri	July 24, 1853	1913	Jan. 15, 1948
de Vries, Hugo	Feb. 16, 1848	1904	May 21, 1935
Dewar, Sir James	Sept. 20, 1842	1907	Mar. 27, 1923
Dove, Heinrich Wilhelm	Oct. 6, 1803	1867	Apr. 4, 1879
du Bois-Reymond, Emil	Nov. 7, 1818	1892	Dec. 26, 1896
Dumas, Jean Baptiste	July 15, 1800	1883	Apr. 11, 1884
Dyson, Sir Frank Watson	Jan. 4, 1868	1926	May 25, 1939
Eddington, Sir Arthur Stanley	Dec. 28, 1882	1925	Nov. 21, 1944
Ehrlich, Paul	Mar. 14, 1854	1904	Aug. 20, 1915
Eijknan, Christiaan	Aug. 11, 1858	1921	Nov. 5, 1930
Engler, Adolph	Mar. 25, 1844	1925	Oct. 10, 1930
Eskola, Pentti Eelis	Jan. 8, 1883	1951	Dec. 6, 1964
Faraday, Michael	Sept. 22, 1791	1864	Aug. 25, 1867
Fauré-Fremiet, Emmanual	Dec. 29, 1883	1968	Nov. 6, 1971
Fischer, Emil	Oct. 9, 1852	1904	July 15, 1919
Fisher, Sir Ronald Aylmer	Feb. 17, 1890	1948	July 29, 1962
Florey, Howard Walter (Baron Florey of Adelaide)	Sept. 24, 1898	1963	Feb. 21, 1968
Forsyth, Andrew Russell	June 18, 1858	1907	June 2, 1942
Fowler, Alfred	Mar. 22, 1868	1938	June 24, 1940
Gegenbaur, Karl	Aug. 21, 1826	1891	June 14, 1903
Geijer, Per	July 7, 1886	1958	Apr. 18, 1976
Geikie, Sir Archibald	Dec. 28, 1835	1901	Nov. 10, 1924
Gill, Sir David	June 12, 1843	1898	Jan. 24, 1914
Goebel, Karl E. Ritter von	Mar. 8, 1855	1932	Oct. 10, 1932
Gregory, Frederick Gugenheim	Dec. 22, 1893	1956	Nov. 27, 1961
Groth, Paul von	June 23, 1843	1905	Dec. 2, 1927
Gyldén, Hugo	May 29, 1841	1892	Nov. 9, 1896
Haber, Fritz	Dec. 9, 1868	1932	Feb. 1, 1934
Hadamard, Jacques	Dec. 8, 1865	1926	Oct. 17, 1963
Hadfield, Sir Robert A.	Nov. 28, 1858	1928	Sept. 30, 1940
Hadorn, Ernest	May 31, 1902	1969	Apr. 4, 1976
Haldane, John Burdon Sanderson	Nov. 5, 1892	1964	Dec. 1, 1964
Haldane, John Scott	May 2, 1860	1935	Mar. 15, 1936
Hamilton, Sir William Rowan	Aug. 4, 1805	1864	Sept. 2, 1865
Hardy, Godfrey Harold	Feb. 7, 1877	1927	Dec. 1, 1947
Hartmann, Max	July 7, 1876	1959	Oct. 11, 1962
Heim, Albert	Apr. 12, 1849	1913	Aug. 31, 1937
Heisenberg, Werner	Dec. 5, 1901	1961	Feb. 1, 1976
Helland-Hansen, Bjorn	Oct. 16, 1877	1947	Sept. 7, 1957
Helmholtz, Hermann L. F. von (Baron von Helmholtz)	Aug. 31, 1821	1883	Sept. 8, 1894
Hertwig, Richard	Sept. 23, 1850	1929	Oct. 3, 1937
Hilbert, David	Jan. 23, 1862	1907	Feb. 18, 1943
Hill, James Peter	Feb. 21, 1873	1940	May 24, 1954
Hinshelwood, Sir Cyril Norman	June 19, 1897	1960	Oct. 9, 1967
Hodge, Sir William Vallance D.	June 17, 1903	1959	July 7, 1975
Hoff, Jacobus Hendricus van't	Aug. 30, 1852	1901	Mar. 1, 1911
Hofmann, August Wilhelm	Apr. 8, 1818	1887	May 5, 1892
Hooker, Sir Joseph Dalton	June 30, 1817	1883	Dec. 10, 1911
Hopf, Heinz	Nov. 19, 1894	1957	June 3, 1971
Hopkins, Sir Frederick Gowland	June 20, 1861	1924	May 16, 1947
Houssay, Bernardo Alberto	Apr. 10, 1887	1940	Sept. 21, 1971
Huggins, Sir William	Feb. 7, 1824	1904	May 10, 1910
Huxley, Thomas Henry	May 4, 1825	1883	June 29, 1895
Ibañez, Carlos	Apr. 14, 1825	1889	Jan. 29, 1891
Janet, Pierre	May 30, 1859	1938	Feb. 24, 1947
Janssen, Pierre Jules Cesar	Feb. 22, 1824	1901	Dec. 23, 1907
Jones, Sir Harold Spencer	Mar. 29, 1890	1943	Nov. 3, 1960
Jordan, Marie Ennemond Camille	Jan. 5, 1838	1920	Jan. 21, 1922
Joule, James Prescott	Dec. 24, 1818	1887	Oct. 11, 1889
Kapteyn, J. C.	Jan. 19, 1851	1907	June 18, 1922
Karrer, Paul	Apr. 21, 1889	1945	June 18, 1971
Katzir-Katchalsky, Aharon	Sept. 1914	1971	May 30, 1972
Keith, Sir Arthur	Feb. 5, 1866	1941	Jan. 7, 1955

DECEASED FOREIGN ASSOCIATES—Continued

	Date of birth	Date of election	Date of death
Kekulé, August	Sept. 7, 1829	1892	July 13, 1896
Kelvin, William Thomson (Baron Kelvin of Largs)	June 26, 1824	1883	Dec. 17, 1907
Kirchoff, Gustav Robert	Mar. 12, 1824	1883	Oct. 17, 1887
Klein, Felix	Apr. 25, 1849	1898	June 22, 1925
Knorski, Jerzy	Dec. 1, 1903	1963	Sept. 14, 1973
Koch, Robert	Dec. 11, 1843	1903	May 28, 1910
Kohlrausch, Friedrich	Oct. 14, 1840	1901	Jan. 17, 1910
Kölliker, Albert von	July 6, 1817	1883	Nov. 2, 1905
Kossel, Albrecht	Sept. 16, 1853	1913	July 5, 1927
Krishnan, Sir Kariamanikkam Srinivasa	Dec. 4, 1898	1956	June 14, 1961
Krogh, August	Nov. 15, 1874	1937	Sept. 13, 1949
Kronecker, Hugo	Jan. 27, 1839	1901	June 6, 1914
Kuno, Hisashi	Jan. 7, 1910	1963	Aug. 6, 1969
Küstner, Karl Friedrich	Aug. 22, 1856	1913	Oct. 15, 1936
Lacaze-Duthiers, Henri de	May 15, 1821	1898	July 21, 1901
Lacroix, Francois Antoine Alfred	Feb. 4, 1863	1920	Mar. 16, 1948
Landau, Lev Davidovich	Jan. 22, 1908	1960	Apr. 1, 1968
Lankester, Sir E. Ray	May 15, 1847	1903	Aug. 15, 1929
Larmor, Sir Joseph	July 11, 1857	1908	May 19, 1942
Laue, Max von	Oct. 9, 1879	1958	Apr. 24, 1960
Leuckart, Rudolph	Oct. 7, 1822	1895	Feb. 6, 1898
Levi, Giuseppe	Oct. 14, 1872	1940	Feb. 4, 1965
Lie, Sophus	Dec. 17, 1842	1895	Feb. 18, 1899
Liebig, Justus von	May 12, 1803	1867	Apr. 18, 1873
Lindblad, Bertil	Nov. 26, 1895	1955	June 25, 1965
Linderstrom-Lang, Kaj Ulrik	Nov. 29, 1896	1947	May 25, 1959
Lister, Joseph (1st Baron Lister of Lyme Regis)	Apr. 5, 1827	1898	Feb. 10, 1912
Loewy, Maurice	Apr. 15, 1833	1901	Oct. 15, 1907
Lorentz, Hendrik Antoon	July 18, 1853	1906	Feb. 4, 1928
Ludwig, Karl F. W.	Dec. 29, 1816	1893	Apr. 24, 1895
Lundegardh, Henrik Gunnar	Oct. 23, 1888	1964	Nov. 16, 1969
Lyot, Bernard Ferdinand	Feb. 27, 1897	1949	Apr. 1, 1952
Marconi, Marchese Guglielmo	Apr. 25, 1874	1932	July 20, 1937
Marey, Etienne Jules	Mar. 5, 1830	1903	May 15, 1904
Mendeléef, Dimitri I.	Feb. 8, 1834	1903	Feb. 2, 1907
Michotte, Albert Edouard (Baron Michotte van den Berck)	Oct. 13, 1881	1956	June 2, 1965
Milne-Edwards, Henri	Oct. 23, 1800	1864	July 29, 1885
Minnaert, Marcel Gilles Jozef	Feb. 12, 1893	1964	Oct. 26, 1970
Moissan, Henri	Sept. 28, 1852	1898	Feb. 20, 1907
Monod, Jacques	Feb. 9, 1910	1968	May 31, 1976
Murchison, Sir Roderick I.	Feb. 19, 1792	1865	Oct. 22, 1871
Murray, Sir John	Mar. 3, 1841	1912	Mar. 16, 1914
Onnes, Heike Kamerlingh	Sept. 21, 1853	1920	Feb. 21, 1926
Oppolzer, Theodor von	Oct. 26, 1841	1883	Dec. 26, 1886
Ostwald, Wilhelm	Sept. 2, 1853	1906	Apr. 4, 1932
Owen, Sir Richard	Jan. 6, 1810	1865	Dec. 18, 1892
Parsons, Sir Charles Algeron	June 13, 1854	1925	Feb. 11, 1931
Pasteur, Louis	Dec. 27, 1822	1883	Sept. 28, 1895
Pavlov, Ivan Petrovic	Sept. 22, 1849	1908	Feb. 27, 1936
Penck, Albrecht	Sept. 25, 1858	1909	Mar. 9, 1945
Penfield, Wilder	June 26, 1891	1953	Apr. 7, 1976
Pérès, Joseph Jean Camille	Oct. 31, 1890	1956	Feb. 12, 1962
Peters, Christian August Friedrich	Sept. 7, 1806	1867	May 8, 1880
Pfeffer, Wilhelm	Mar. 9, 1845	1903	Jan. 31, 1920
Picard, Emile	July 24, 1856	1903	Dec. 12, 1942
Pieron, Henri	July 18, 1881	1949	Nov. 6, 1964
Plana, G. A. A.	Nov. 8, 1781	1864	Jan. 20, 1864
Planck, Max	Apr. 23, 1858	1926	Oct. 4, 1947
Poincaré, Jules Henri	Apr. 29, 1854	1898	July 17, 1912
Portévin, Albert Marcel Germain René	Nov. 1, 1880	1954	Apr. 12, 1962
Prain, Sir David	July 11, 1857	1920	Mar. 16, 1944
Rammelsberg, Karl Friedrich	Apr. 1, 1813	1893	Dec. 28, 1899
Ramon y Cajal, Santiago	May 1, 1852	1920	Oct. 17, 1934
Ramsay, Sir William	Oct. 2, 1852	1904	July 23, 1916
Rayleigh, John Wm. Strutt (3d Baron Rayleigh)	Nov. 12, 1842	1898	June 30, 1919
Regnault, Victor	July 21, 1810	1865	Jan. 19, 1878
Renner, Otto	Apr. 25, 1883	1954	July 8, 1960
Retzius, Gustav	Oct. 17, 1842	1909	July 21, 1919
Richthofen, Ferdinand von	May 5, 1833	1883	Oct. 6, 1905
Robinson, Sir Robert	Sept. 13, 1886	1934	Feb. 8, 1975
Rosenbusch, Karl Harry Ferdinand	June 24, 1836	1904	Jan. 20, 1914
Roux, Wilhelm	June 9, 1850	1924	Sept. 15, 1924
Rubner, Max	June 2, 1854	1924	Apr. 27, 1932
Rutherford, Ernest (1st Baron Rutherford of Nelson)	Aug. 30, 1871	1911	Oct. 19, 1937
Sabatier, Paul	Nov. 5, 1854	1927	Aug. 5, 1941
Sachs, Julius von	Oct. 2, 1832	1895	May 29, 1897
Schiaparelli, Giovanni	Mar. 14, 1835	1910	July 4, 1910
Schneider, Charles Eugene	Oct. 29, 1868	1925	Nov. 17, 1942
Schuster, Sir Arthur	Sept. 12, 1851	1913	Oct. 14, 1934
Seeliger, Hugo R. von	Sept. 23, 1849	1908	Dec. 2, 1924
Sherrington, Sir Charles	Nov. 27, 1857	1924	Mar. 4, 1952
Sommerfeld, Arnold	Dec. 5, 1868	1929	Apr. 25, 1951
Sorensen, Soren Peter Lauritis	Jan. 9, 1868	1938	Feb. 12, 1939
Southwell, Sir Richard Vynne	July 2, 1888	1943	Dec. 9, 1970

DECEASED FOREIGN ASSOCIATES—Continued

	Date of birth	Date of election	Date of death
Spearman, Charles Edward	Sept. 10, 1863	1943	Sept. 17, 1945
Spemann, Hans	July 27, 1869	1925	Sept. 12, 1941
Stas, Jean Servais	Sept. 20, 1813	1891	Dec. 13, 1891
Steacie, Edgar W. R	Dec. 25, 1900	1957	Aug. 28, 1962
Stokes, Sir George G	Aug. 13, 1819	1883	Feb. 1, 1903
Strasburger, Eduard	Feb. 1, 1844	1898	May 19, 1912
Struve, Otto von	Apr. 25, 1819	1883	Apr. 14, 1905
Stumpf, Carl	Apr. 21, 1848	1927	Dec. 29, 1936
Suess, Eduard	Aug. 20, 1831	1898	Apr. 26, 1914
Svedberg, Theodor (The)	Aug. 30, 1884	1945	Feb. 26, 1971
Sverdrup, Harald Ulrik [1]	Nov. 15, 1888	1952	Aug. 20, 1957
Sylvester, James Joseph	Sept. 3, 1814	1883	Mar. 15, 1897
Taylor, Sir Geoffrey	May 7, 1886	1945	June 27, 1975
Thompson, Sir D'Arcy	May 2, 1860	1943	June 21, 1948
Thomson, Sir Godfrey	Mar. 21, 1881	1951	Feb. 9, 1955
Thomson, Sir Joseph J	Dec. 18, 1856	1903	Aug. 30, 1940
Tiselius, Arne W. K	Aug. 10, 1902	1949	Oct. 29, 1971
Tisserand, Francois Félix	Jan. 13, 1845	1893	Oct. 30, 1896
Vallée-Poussin, C. de la	1886	1929	1962
van der Bijl, Hendrik Johannes	Nov. 23, 1887	1943	Dec. 2, 1948
Van der Waals, J. D	Nov. 23, 1837	1913	Mar. 8, 1923
Vening Meinesz, Felix Andries	July 30, 1887	1939	Aug. 10, 1966
Virchow, Rudolph von	Oct. 13, 1821	1883	Sept. 5, 1902
Virtanen, Artturi Ilmari	Jan. 15, 1895	1969	Nov. 11, 1973
Vogel, Hermann Carl	Apr. 3, 1841	1903	Aug. 13, 1907
Volterra, Vito	May 3, 1860	1911	Oct. 11, 1940
Waldoyer, Wilhelm	Oct. 6, 1836	1909	Jan. 23, 1921
Watson, David Meredith Seares	June 18, 1886	1938	July 23, 1973
Weierstrass, Karl	Oct. 31, 1815	1892	Feb. 19, 1897
Weismann, August	Jan. 17, 1834	1913	Nov. 5, 1914
Wieland, Heinrich	June 4, 1877	1932	Aug. 5, 1957
Westergaard, Mogens C. W	June 12, 1912	1972	June 8, 1975
Willstaetter, Richard	Aug. 13, 1872	1926	Aug. 2, 1942
Winge, Ojvind	May 10, 1886	1949	Apr. 5, 1964
Wöhler, Friedrich	July 31, 1800	1865	Sept. 23, 1882
Wolf, Max F. J. C	June 21, 1863	1913	Oct. 3, 1932
Wundt, Wilhelm	Aug. 16, 1832	1909	Aug. 31, 1920
Würtz, Adolphe	Nov. 26, 1817	1883	May 12, 1884
Zirkel, Ferdinand	May 20, 1838	1903	June 11, 1912
Zittle, K. A. R. von	Sept. 25, 1839	1898	Jan. 5, 1904

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[1] Resigned Academy membership on Apr. 2, 1951, when he had maintained residence in Norway for 3 years, thereby losing his American citizenship. Elected a foreign associate in 1952.

APPENDIX II

THE NATIONAL ACADEMY OF ENGINEERING

AUTUMN MEETING, 1975

The Eleventh Autumn Meeting of the NAE was held at the National Academy of Sciences Building in Washington, D.C., on November 10, 1975. The Business Session for members was held in the morning, and was followed in the afternoon by presentations on "Energy, Space, Research: A Federal Perspective", which comprised the Technical Session.

BUSINESS SESSION

The following 94 members attended the Autumn Business Session held in the auditorium of the NAS Building:

William G. Agnew
Betsy Ancker-Johnson
Edward J. Barlow
Lynn S. Beedle
James Boyd
Willard S. Boyle
J. H. U. Brown
James Robert Burnett
Henri Busignies
Dean R. Chapman
Joseph V. Charyk
Paul F. Chenea
Harold Chestnut
Nathan Cohn
Edward N. Cole
C. Chapin Cutler
James W. Daily
Lee L. Davenport
Kurt H. Debus
John H. Dessauer
Robert M. Drake, Jr.
Daniel C. Drucker
Ernst R. G. Eckert
Ersel A. Evans
Ralph E. Fadum
Daniel J. Fink
James B. Fisk
Alexander H. Flax
James C. Fletcher
Richard G. Folsom
Sheldon K. Friedlander
Edward L. Ginzton
T. Keith Glennan
Martin Goland
Edward J. Gornowski
John V. N. Granger
Robert C. Gunness
Lawrence R. Hafstad
N. Bruce Hannay
W. Lincoln Hawkins
Thomas J. Hayes III
S. W. Herwald
James Hillier
Frederic A. L. Holloway
John A. Hornbeck
Arthur Humphrey
Robert I. Jaffee
James R. Johnson
Wendell E. Johnson
J. Erik Jonsson
John R. Kiely
Ernest S. Kuh
Clarence E. Larson
Harold Liebowitz
Henry R. Linden
William D. Manly
Edward A. Mason
Hans A. Mauch
Kenneth G. McKay
Stewart E. Miller
James H. Mulligan, Jr.
Eugene F. Murphy
Theodore J. Nagel
Kenneth D. Nichols
Russell R. O'Neill
Hilliard W. Paige
Thomas O. Paine
Nunzio J. Palladino
Courtland D. Perkins
Rocco A. Petrone
Joseph M. Pettit
Samuel C. Phillips
Jan A. Rajchman
Eberhardt Rechtin
Paul Rosenberg
Herman P. Schwan
Robert C. Seamans, Jr.
Joseph F. Shea
William G. Shepherd
William E. Shoupp
George E. Solomon
Morgan Sparks
Phillip Sporn
H. Guyford Stever
Morris Tanenbaum
Richard H. Tatlow III
John J. Taylor
John W. Townsend, Jr.
Howard S. Turner
Eric A. Walker
Arthur H. Waynick
Robert M. White
F. Karl Willenbrock
George Winter

President Perkins commented on the current state of Academy operations and various aspects of the relationship between the NAS and NAE. He reported on Academy activities since he assumed the presidency on July 1, 1975, and outlined objectives deemed to be of importance for the NAE in the coming year. He summarized these as: strengthening the Academy's capacity and availability for national service through continuing identification of salient engineering issues; and increasing effective participation in the activities of the NRC. In this connection, noting that the President of the NAE serves as Vice Chairman of the NRC, and, at the present time, as Chairman of the Assembly of Engineering, he reviewed briefly the program activities administered by that Assembly.

Commenting on membership election affairs, President Perkins observed that the Academy would be electing individuals in the foreign associates category for the first time in the current election, to be concluded in the spring of 1976. He also stressed the importance of initiative in developing new programs deemed to be supportive of the NAE in its role as a member of the Academy corporation as well as special projects such as ad hoc studies and public meetings. He noted that, with the endorsement of the Council, he was proceeding with efforts to strengthen the financial base of the Academy.

The Business Session was followed immediately by the Founders Lecture, given by James B. Fisk, retired Chairman of Bell Laboratories, and recipient of the Academy's Tenth Founders Medal. Mr. Fisk's comments dealt with the relationship of research, engineering and innovation, and the future role of the NAE.

TECHNICAL SESSION

The Technical Session held the afternoon of November 10, 1975, consisted of presentations on "Energy, Space, Research: A Federal Perspective". The speakers were Academy members Robert C. Seamans, Jr., James C. Fletcher and H. Guyford Stever, administrators of the Energy Research and Development Administration, the National Aeronautics and Space Administration and the National Science Foundation, respectively, three federal agencies which currently support a substantial amount of the work conducted by the NRC.

ANNUAL MEETING, 1976

The Twelfth Annual Meeting of the National Academy of Engineering was held on April 28–29, 1976, at the National Academy of Sciences Building, Washington, D.C. A joint NAE-NAS symposium and workshops on "Materials and the Development of Nations: The Role of Technology" on April 28 and the morning of April 29 comprised the Technical Session. The Business Session was held the morning of April 29, immediately preceding that day's portion of the Technical Session.

Members and their guests attended the President's Reception and Banquet at the Sheraton Park Hotel, Washington, D.C., the evening of April

28. Presentation of Vladmir K. Zworykin Award for Electronic Engineering was made during the banquet to C. Kumar N. Patel, Director of the Physical Research Laboratory at Bell Laboratories. Dr. Patel was cited for his original contributions in the area of laser technology.

The recipient of the Eleventh Founders' Award, also presented at the banquet, was Manson Benedict, Institute Professor Emeritus at the Massachusetts Institute of Technology. Dr. Benedict was cited for his contributions to the development of atomic energy technology and his leadership in nuclear engineering education. It was announced that the traditional Founders Lecture by the recipient would be presented at the time of the 1976 Autumn Meeting.

The banquet program included an address on "Satellite Communications" by Joseph V. Charyk, President, Communications Satellite Corporation. In honor of the nation's Bicentennial, Gunnar Hambraeus, President of the Swedish Academy of Engineering Sciences, on behalf of his institution, presented President Perkins with a facsimile of the 1876 edition of John Ericsson's *Contributions to the Centennial Exhibition.*

The Special Program for members' spouses and guests was held the morning of April 28. This included a walking tour of Lafayette Square and luncheon at Decatur House.

TECHNICAL SESSION

A symposium and workshops on the subject of "Materials and the Development of Nations: The Role of Technology", was held under the joint sponsorship of the NAE and the NAS on April 28 and 29.

The program was intended to provide for the presentation of different perceptions of the overall problems and issues associated with materials availability and interdependence, and consideration of new ways of thinking about materials development and technology on a global basis. The program Steering Committee was comprised of Rustum Roy, Chairman, and W. O. Baker, S. L. Blum, Harvey Brooks, Edward N. Cole, Walter R. Hibbard, Jr., Charles J. Hitch, J. Herbert Hollomon, Elburt F. Osborn, S. Victor Radcliffe and Klaus-Heinrich Standke. The symposium and workshops program is outlined below:

Wednesday, April 28, 1976

Morning

Chairman

Gunnar Hambraeus, *President,* Royal Swedish Academy of Engineering Sciences

Welcoming remarks

Philip Handler, *President,* National Academy of Sciences.

Courtland D. Perkins, *President,* National Academy of Engineering.

Keynote address

Lord Ritchie-Calder, *Author and University Professor*, Edinburgh, Scotland, Great Britain.

EXPOSITION OF DIFFERENT NATIONS' PERCEPTIONS OF MATERIALS SUPPLY AND DEMAND PROBLEMS (NEAR- AND LONG-TERM) AND RELATED ISSUES

Less developed, resource-rich nation

Rafael Sandrea, member of the board, Foundation For Petroleum and Petrochemical Research, Caracas, Venezuela.

Less developed, resource-poor nation

Ronald D. Ridker, Fellow in Charge of Program on Population, Resources, and the Environment; Resources for the Future, Inc., Washington, D.C., U.S.A.

Relatively developed, resource-rich nation

Stuart Harris, Professor of Resource Economics, Centre for Resource and Environmental Studies, The Australian National University, Canberra, Australia.

Developed, relatively resource-rich nation

Henry R. Nau, Special Assistant to the Under Secretary of State for Economic Affairs, United States Department of State, Washington, D.C., U.S.A.

Afternoon

Chairman

Edward N. Cole, *Chairman of the Board*, International Husky Inc.

SELECTING APPROPRIATE TECHNOLOGIES FOR VARYING NATIONAL ECONOMIES

Utilization of new technology in the Soviet planned economy

Herbert S. Levine, Professor of Economics, Faculty of Arts and Sciences, University of Pennsylvania, Philadelphia, Pennsylvania, U.S.A. (also Senior Research Consultant, Stanford Research Institute).

Utilization of new technology in developing countries

Klaus-Heinrich Standke, Director, Office of Science and Technology, United Nations, New York, U.S.A.

CONCURRENT WORKSHOPS ON THE STATE OF RELEVANT TECHNOLOGIES

Resource identification and development

CHAIRMAN

Elburt F. Osborn, Distinguished Professor, Geophysical Laboratory, Carnegie Institution of Washington, D.C., U.S.A.

PANELISTS

James Boyd (Rapporteur), President, Materials Associates, Washington, D.C., U.S.A.

Philip W. Guild, Research Geologist, Office of Research Analysis, U.S. Geological Survey, Department of Interior.

Mordeckai Margaritz, Research Associate, Department of Terrestrial Magnetism, Carnegie Institution of Washington.

John D. Morgan, Associate Director, Mineral and Materials Supply/Demand Analysis, Bureau of Mines, U.S. Department of Interior.

John A. Reinemund, Chief, Office of International Geology, U.S. Geological Survey, U.S. Department of Interior, Reston, Virginia, U.S.A.

Lawrence C. Rowan, Geologist, U.S. Geological Survey, Department of Interior.

Stephen H. Spurr, Professor, Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin, Austin, Texas, U.S.A.

Bension Varon, Assistant Director for Policies and Projections, Center for National Resources, Energy, and Transport, United Nations, New York, New York, U.S.A.

Processing

CHAIRMAN

Rustum Roy, Director, Material Research Laboratory and Professor of the Solid State, The Pennsylvania State University, University Park, Pennsylvania, U.S.A.

PANELISTS

D. Altenpohl, Director of Technology, Swiss Aluminum, Ltd., Zurich, Switzerland.

Vincent Hill, Commissioner of Mines, Ministry of Mining and Natural Resources, Kingston, Jamaica, West Indies.

Gunnar M. Idorn, Vice President, Aalborg Portland Research and Development, Karlslunde, Denmark.

Robert I. Jaffee (Rapporteur), Technical Manager, Materials, Fossil Fuels & Advanced Systems, Electric Power Research Institute, Palo Alto, California, U.S.A.

Stanley H. Ruttenberg, President, Ruttenberg, Friedman, Kilgallon, Gutchess & Associates, Inc., Economists and Manpower Counselors, Washington, D.C., U.S.A.

Conservation/Recycling

CHAIRMAN

S. L. Blum, Director, Advanced Program Development, The MITRE Corporation, Bedford, Massachusetts, U.S.A.

PANELISTS

Michael B. Bever (Rapporteur), Professor of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A.

W. P. Fornerod, Deputy Director, Netherlands' Organization for Applied Scientific Research, Delft, The Netherlands.

J. J. Harwood, Director, Materials Sciences Laboratory, Engineering & Research Staff, Ford Motor Company, Dearborn, Michigan, U.S.A.

Lois Sharpe, Staff Director for Environmental Department, League of Women Voters Educational Fund, Washington, D.C., U.S.A.

Substitution

CHAIRMAN

Walter R. Hibbard, Jr., University Distinguished Professor, College of Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, U.S.A.

PANELISTS

W. J. Arrol, Director of Research, Group Research Centre, Joseph Lucas Limited, Lucas Industries, Shirley Solihull, West Midlands, England.

James S. Bethel, Dean, College of Forest Resources, The University of Washington, Seattle, Washingon, U.S.A.

Gunnar Hambraeus, President, Royal Swedish Academy of Engineering Sciences, Stockholm, Sweden.

Alan M. Lovelace (Rapporteur), Associate Administrator for Aeronautics and Space Technology, National Aeronautics and Space Administration, Washington, D.C., U.S.A.

Shintaro Tabata, Executive Director, Iron and Steel Institute of Japan, Tokyo, Japan (to be confirmed).

THURSDAY, APRIL 29, 1976

CHAIRMAN

W. O. Baker, President, Bell Laboratories, Murray Hill, New Jersey, U.S.A.

PANELISTS

Speakers of the previous day: Stuart Harris; Herbert S. Levine; Lord Ritchie-Calder; Rafael Sandrea; and Klaus-Heinrich Standke.

Workshop rapporteurs: Michael B. Bever; James Boyd; Robert I. Jaffee; and Alan M. Lovelace.

Modeling and Materials: The State of the Art

S. Victor Radcliffe, Fellow, Resources for the Future, Inc., Washington, D.C., U.S.A.

Reports of the Workshop Rapporteurs

Response of Speakers Regarding the Potential Impact of the Relevant Technologies on the Perceived Problems

Open Discussion with Audience Participation

Summation and Recommendations for Future Action

J. Herbert Hollomon, Director, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A.

BUSINESS SESSION

One hundred and twenty-four members attended the Business Session of the Twelfth Annual Meeting of the National Academy of Engineering, held on April 29, 1976, in the Auditorium of the National Academy of Sciences Building, Washington, D.C. Present were:

Gene M. Amdahl
W. Howard Arnold, Jr.
Rupert L. Atkin
Roy Bainer
W. O. Baker
Benjamin B. Bauer
Horace S. Beattie
Lynn S. Beedle
Daniel Berg
James Boyd
Lewis Branscomb
John E. Breen
Charles M. Brinckerhoff
Robert Bromberg
Joseph E. Burke
Robert H. Cannon, Jr.
Paul F. Chenea
Harold Chestnut
Dayton H. Clewell
Morris Cohen
Edward N. Cole
John W. Coltman
F. J. Corbato
C. Chapin Cutler
W. Kenneth Davis
Joseph K. Dillard
Jacob H. Douma
Robert M. Drake, Jr.
Charles S. Draper
Daniel C. Drucker
Phillip Eisenberg
Lloyd E. Elkins
John F. Elliott
Martin A. Elliott
James C. Elms
Elliott M. Estes
Bob O. Evans
Steven J. Fenves
Daniel J. Fink
Ulrich Finsterwalder[1]
Merton C. Flemings
Richard G. Folsom
Gerard F. Fox
Douglas W. Fuerstenau
Robert A. Fuhrman
Charles P. Ginsburg
John B. Goodenough
Paul E. Gray
Lawrence R. Hafstad
N. Bruce Hannay
Edwin L. Harder
Cyril M. Harris
Milton Harris
W. L. Hawkins
Willis M. Hawkins
Joseph M. Hendrie
Walter R. Hibbard
James Hillier
J. Herbert Holloman
Frederic A. L. Holloway
J. Donovan Jacobs
Robert I. Jaffee
Wendell E. Johnson
Donald J. Jordan
Robert W. Keyes
Rudolf Kompfner

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[1] Foreign Associate.

Clarence E. Larson
W. Deming Lewis
Harold Liebowitz
Henry R. Linden
Joseph T. Ling
Robert G. Loewy
John P. Longwell
Alan M. Lovelace
John D. Mackenzie
Edward A. Mason
Hans A. Mauch
Sidney Metzger
Steward E. Miller
James K. Mitchell
James H. Mulligan, Jr.
Albert G. Mumma
Eugene F. Murphy
Eugene F. O'Neill
Russell R. O'Neill
Henry J. Ongerth
Jorj O. Osterberg
Joseph A. Pask
Courtland D. Perkins
Joseph M. Pettit
Samuel C. Phillips
Egor P. Popov
Jan A. Rajchman
Eric Reissner
Joe B. Rosenbaum
Paul Rosenberg
Rustum Roy
Allen S. Russell
Robert S. Schechter
William E. Shoupp
Donald B. Sinclair
William P. Slichter
Ronald Smelt
Joe Mauk Smith
Robert L. Smith
Morgan Sparks
Philip Sporn
Archie W. Straiton
Ivan E. Sutherland
Morris Tanenbaum
Richard H. Tatlow
John J. Taylor
Anton Tedesko
J. George Thon
Chang Lin Tien
Myron Tribus
Henning E. von Gierke
John B. Wachtman
Ernst Weber
Johannes Weertman
James G. Wenzel
Albert D. Wheelon
Robert M. White
James F. Young

President's Announcements

President Perkins announced that in the interval since the 1975 Annual Meeting, NAE members Antonio Ferri, Henry T. Heald, Percy T. McGauhey, Thomas K. Sherwood and Karl Schwartzwalder had passed away, and asked the membership to stand for a moment of silent tribute.

Report of the Treasurer

Treasurer Edward N. Cole submitted a report for the fiscal year ended June 30, 1975. As of July 1, 1974, the balance in the NAE general fund was $75,472. The balance as of June 30, 1975, was $126,598. The report of the Treasurer was accepted.

Report of the Auditing Committee

The Auditing Committee for 1975–76, consisting of Karl L. Fetters, serving as Chairman, Harry F. Barr and Thomas O. Paine, reviewed the Report of the Treasurer, NAS, for the fiscal year ended June 30, 1975, including the Auditor's Report prepared by Price Waterhouse & Co. for the NAS. The committee also reviewed the Treasurer's Statement for the NAE for the same period, which includes the status of the General Fund of the National Academy of Engineering as of June 30, 1975, prepared by the Accounting Office of the National Academy of Sciences based on the audited information contained in the Report of the Treasurer, NAS, referenced above.

The committee noted that with the transfer of the advisory activities of the NAE to the Assembly of Engineering of the National Research Council on July 1, 1974, a separate audit of NAE accounts was not deemed necessary and that it so recommended, since information on the general fund of the NAE is subsumed in the aforementioned Report of the Treasurer, NAS, for the total corporation.

The Report of the Auditing Committee was accepted by the membership. President Perkins thereupon announced the appointment of the following individuals to the Auditing Committee for the 1976–77 activities year: Daniel J. Fink, Chairman, George B. Brown, Thomas O. Paine.

Report of the Secretary

Secretary J. H. Mulligan, Jr. announced the election of four individuals to serve as members of the Council as follows:

Reelected to serve 3-year terms commencing with the close of the 1976 Annual Meeting: Ralph Landau, Joseph M. Pettit;

Reelected to serve for a 1-year term commencing at the close of the 1976 Annual Meeting: Frederic A. L. Holloway;

Elected to serve for a 3-year term commencing at the close of the 1976 Annual Meeting: Samuel C. Phillips.

The Secretary reported that the Thirteenth Membership Election concluded in April had resulted in the election of 104 individuals to membership, bringing the total membership to 685. He also reported on the election of 21 foreign associates, noting that this was the first time the Academy had elected individuals in this category.

Amendment to Bylaws

President Perkins noted that at its meeting on February 2, 1976, the Council had considered the question of the maximum period of time it would be desirable for an individual to serve on the Council and the appropriate number of consecutive terms to which Councilors could be reelected. As a result of its discussion, the Council adopted a resolution recommending to the membership the adoption of the following amendment to Article V, Section 1, of the Bylaws (language to be added indicated by italics; deletions indicated by brackets).

> "SECTION 1. Membership; Term. The Council of the Academy shall consist of the president, vice president, and treasurer of the Academy; the president of the National Academy of Sciences; the vice chairman of the National Research Council; and twelve members of the Academy to be elected by the membership. In addition, the immediate past president of the Academy shall be a member of the Council for a period of one year immediately following the conclusion of his term of office.
>
> The terms of the twelve members of the Council who are elected by the membership shall be arranged on a staggered basis. Thereafter, at each annual meeting, [four] an *appropriate number of* members of the Academy shall be elected to the Council for a term [of] *not to exceed* three years. *No member of the Council, excluding officers, shall be elected for a total term of service in excess of six years.* The term

of each member of the Council shall expire at the close of the annual meeting at which [his] *a* successor is elected, except that the term of a retiring president of the Academy shall expire one year after his retirement."

Upon motion duly made and seconded, the proposed amendment was adopted as presented by the members present by voice vote.

Report of the President

President Perkins commented on the state of Academy operations, briefly reviewing activities since he took office on July 1, 1975. He reviewed the development of a statement of goals for the NAE, observing that it had received Council endorsement. He commented on the statement, presented below, which was included in a descriptive brochure on the NAE which had been sent to the members, in particular addressing the first and seventh items:

1. To use more effectively the unique capabilities of the NAE and its membership to identify, define and activate significant technical initiatives in support of the NAE and the NRC.
2. To expand the role of the NAE in international programs involving engineering and technology.
3. To enlarge and make more effective the role of the NAE as an objective spokesman for the engineering community on matters involving the interactions of technology with societal and public policy issues.
4. To increase the membership of the NAE, maintaining high standards, and considering balance in the technical disciplines and in the representation of academia, industry and government.
5. To develop strong cooperative relationships with the major professional engineering societies.
6. To strengthen further the cooperative partnership of the NAE and the NAS.
7. To develop independent financial resources to support adequately both the honorific and functional objectives of the NAE.

In concluding, President Perkins stressed the desirability of continued involvement of the members in the activities of the Academy and the NRC.

ARTICLES OF ORGANIZATION

Approved by the Council of the National Academy of Sciences, December 5, 1964.

ARTICLE I. CREATION AND COMPLETION OF ORGANIZATION

The National Academy of Sciences, under the authority conferred upon it by its Charter enacted by the Congress, adopts the following Articles of Organization for the National Academy of Engineering.

SECTION 1. The National Academy of Engineering (hereinafter called the "Academy") shall be an institution with the powers, limitations, and restrictions contained in these articles of organization.

SECTION 2. The following persons are named as the Founding Members of the Academy: Hendrik Wade Bode, Walker Lee Cisler, Hugh Latimer Dryden, Elmer William Engstrom, William Littell Everitt, Antoine Marc Gaudin, Michael Lawrence

Haider, George Edward Holbrook, John Herbert Hollomon, Jr., Thomas Christian Kavanagh, Augustus Braun Kinzel, James Nobel Landis, Clarence Hugo Linder, Clark Blanchard Millikan, Nathan Mortimore Newmark, William Hayward Pickering, Simon Ramo, Arthur Emmons Raymond, Thomas Kilgore Sherwood, Julius Adams Stratton, Chauncey Guy Suits, Frederick Emmons Terman, Charles Allen Thomas, Eric Arthur Walker, Ernst Weber.

SECTION 3. *The Founding Members* are authorized to complete the organization of the Academy by the selection of officers and employees, the adoption of bylaws not inconsistent with these articles of organization, the election of such additional members as they may deem appropriate prior to the first annual meeting of the Academy, and the doing of such further acts as may be necessary for such purpose.

ARTICLE II. OBJECTS AND PURPOSES

The objects and purposes of the Academy shall be:

1. To provide means of assessing the constantly changing needs of the nation and the technical resources that can and should be applied to them; to sponsor programs aimed at meeting these needs; and to encourage such engineering research as may be advisable in the national interest.

2. To explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them.

3. To advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering.

4. To cooperate with the National Academy of Sciences on matters involving both science and engineering.

5. To serve the nation in other respects in connection with significant problems in engineering and technology.

6. To recognize in an appropriate manner outstanding contributions to the nation by leading engineers.

ARTICLE III. POWERS

The Academy shall have power:

1. To adopt, alter, and use an official seal.

2. To adopt, amend, and alter bylaws, not inconsistent with these articles of organization, for the regulation of its affairs.

3. To elect additional members.

4. To choose such officers, members of its Council, managers, agents, and employees as the business of the Academy may require.

5. To control and administer any property, real or personal, necessary or proper for attaining the objects and carrying into effect the purposes of the Academy.

6. To make contracts for the performance of services and for the disposition of funds or property that are under its control, in accordance with procedures to be established jointly by the Councils of the National Academy of Engineering and the National Academy of Sciences.

7. To do any other acts and things, not inconsistent with these articles of organization, as may be necessary and proper to carry out the purposes of the Academy.—

provided, however, that the foregoing powers shall not be construed to authorize any act that is inconsistent with Section 501(c)(3) of the Internal Revenue Code or comparable statutory tax-exemption provisions, or with the provisions of the Act of Incorporation of the National Academy of Sciences, as amended.

Article IV. Principal Office; Scope of Activities

The principal office of the Academy shall be located in the District of Columbia. The activities of the Academy may be conducted there or elsewhere.

Article V. Membership

A person shall be qualified as a candidate for membership in the Academy if he personally has made identifiable contributions or accomplishments in one or both of the following categories:

1. Important contributions to engineering theory and practice, including significant contributions to the literature of engineering.
2. Demonstration of unusual accomplishments in the pioneering of new and developing fields of technology.

A candidate for membership shall be recognized by his associates and others for his professional integrity, as well as for his engineering accomplishments. Effectiveness and efficiency in leadership of organizations that have conducted pioneering or complex programs or that have made noteworthy contributions to the field of engineering education should be weighed as supplementing the primary qualifications outlined above.

Article VI. Council; Composition; Responsibilities

Section 1. The composition, terms of office, and manner of election of the Council of the Academy shall be established by its bylaws, except that the President of the National Academy of Sciences, by virtue of his office, shall be a member of the Council of the National Academy of Engineering and of its Executive Committee.

Section 2. The Council shall be the governing board of the Academy and shall, during intervals between meetings of the members, be responsible for the general policies and programs of the Academy. The Council shall be responsible for the control of all funds administered by the Academy.

Section 3. The Council may authorize the payment of compensation to the officers and staff of the Academy for their services as may from time to time be appropriate. In addition, the Council may authorize reimbursement of the officers and members of the Council and of all committees for traveling and other incidental expenses incurred in carrying on the work of the Academy.

Article VII. Officers

The officers of the Academy shall be a president, one or more vice presidents, a secretary, a treasurer, and such other officers as may be prescribed in its bylaws.

Article VIII. Cooperation Between the Academies

Section 1. The Council of the National Academy of Engineering and the Council of the National Academy of Sciences shall each select an equal number of persons to serve as a Joint Board to recommend policies and modes of operation for accomplishing the most effective cooperation between the two Academies and to perform such other functions as may be assigned to it by joint action of the Councils of the two Academies.

Section 2. The National Academy of Engineering shall be solely responsible for the content of reports on projects that it undertakes, and such reports may be issued in its own name.

Section 3. Prior to the expiration of each term of office of the chairman of the Division of Engineering and Industrial Research[*] of the National Research Council, the Council of the National Academy of Engineering shall present to the Council of the National Academy of Sciences the name or names of persons whom the Council of the National Academy of Engineering recommends for appointment to the position.

Section 4. In dealing with the Congress and in matters involving other countries, the National Academy of Engineering shall work jointly with the National Academy of Sciences.

Article IX. Minutes; Financial Records

Section 1. The Academy shall keep minutes of the proceedings of its members, Council, and committees having authority under the Council. It shall also keep books and records of its financial transactions.

Section 2. After the close of each fiscal year, the accounts of the Academy shall be audited by independent certified public accountants. A report of such audit shall be made to the Councils of the National Academy of Engineering and the National Academy of Sciences.

Article X. Restrictions on Activities

Section 1. No part of the income or assets administered by the Academy shall inure to any member or official of the Academy or member of the Council, or be distributable to any such person during the life of the Academy or upon its dissolution or final liquidation. Nothing in this section, however, shall be construed to prevent the payment of reasonable compensation to any such person as authorized in Section 3 of Article VI hereof.

Section 2. No substantial part of the activities of the Academy shall consist of carrying on propaganda or otherwise attempting to influence legislation.

Article XI. Use of Assets on Dissolution or Liquidation

Upon final diss[illegible]r liquidation of the Academy, and after discharge or satisfaction of all the [illegible]g obligations and liabilities for which it is responsible, the remaining assets in the [illegible]s of the Academy shall be distributed in a manner that is consistent with the purposes of the National Academy of Engineering and in accordance with all applicable restrictions and obligations of the National Academy of Sciences. Except as provided in Article XII hereof, such distribution shall be determined by the Council of the National Academy of Sciences.

Article XII. Disposition of Assets Upon Incorporation

Should the Academy be incorporated independently at a later date, all permanent assets under its control (whether by way of endowment or otherwise) shall be transferred to such new corporation, provided that such transfer is not inconsistent with Section 501(c)(3) of the Internal Revenue Code and comparable statutory tax-exemption provisions. The disposition of any funds or property that the Academy is then administering under grants, contracts, and the like shall be determined by agreement between the presidents of the National Academy of Engineering and the National Academy of Sciences.

Article XIII. Amendments

Any proposed amendment to these articles of organization shall be considered by the Council of the Academy and, if two-thirds of the Council approve the same, it shall be submitted to the Council of the National Academy of Sciences. If the latter approves the proposed amendment, the Council of the National Academy of Engineering shall report thereon to the members of that Academy at their next stated meeting. If the proposition is considered favorably by a majority of the members present, it shall be submitted, by notice given to all members of the Academy not less than thirty days in advance, for final action at their next stated meeting. Members who are unable to attend that meeting may send their votes on the proposed amendment to the secretary, and such votes shall be counted as if the members were present. If the proposed amendment is approved by a majority of the votes cast, it shall be declared adopted.

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[*] Now Division of Engineering.

BYLAWS

Adopted by the Founding Members of the National Academy of Engineering, December 10, 1964, and as amended by the membership of the Academy on March 17, 1965; March 24, 1966; February 20, 1967; April 25, 1968; October 31, 1968; May 2, 1969; April 30, 1970; and April 29, 1976.

Article I. Seal

The seal of the National Academy of Engineering (hereinafter called the "Academy") shall be in the form of a circle and shall have inscribed thereon: "National Academy of Engineering, 1964, Official Seal".

Article II. Members, Members Emeriti, and Foreign Associates

Section 1. *Composition.* The Academy shall consist of members, members emeriti, and foreign associates. There shall be no age limit on any of these categories.

Section 2. *Members.* The qualifications of candidates for membership in the Academy are stated in Article V of the Articles of Organization. Members must be citizens of the United States.

Section 3. *Members Emeriti.* Members having reached the age of sixty-five who are retired from active business and professional life, and who wish to be relieved of the status of active membership may, at their own request, be tranferred to the roll of members emeriti. A member emeritus shall not be subject to dues or assessments and shall not be eligible to serve as an officer, a member of the Council, or a chairman of a standing committee. A member emeritus shall have all other privileges of a member, including the right to vote on Academy matters and to serve as a member of committees.

Section 4. *Foreign Associates.* Candidates for election as foreign associates shall meet the requirements for qualification for membership, but shall be nationals of other countries. Foreign associates shall have the privilege of attending meetings and of reading and communicating papers to the Academy, but shall take no part in its business and shall not be subjected to its dues or assessment. A foreign associate of the Academy who becomes a citizen of the United States shall have all the privileges and duties of a member of the Academy, including listing in the roster of members, unless he shall request otherwise.

Section 5. *Dues.* The amount of the annual membership dues shall be recommended by the Council and fixed by the members and shall be payable by the members within thirty days after commencement of the fiscal year for which they are assessed. In the case of newly elected members, dues shall commence with the fiscal year next following the date of election and shall be payable within thirty days of acceptance of election.

Section 6. *Nomination and Election.* Nomination and election of members and foreign associates of the Academy shall be in accordance with procedures developed by the Committe on Membership and approved by the Council. The procedures shall provide for the Council to fix annually the maximum number of new members and new foreign associates to be elected, for nominations to be submitted by members of the Academy to the Committee on Membership, for evaluation of these nominations and subsequent recommendations to the Council by the Committee on Membership, and for presentation of nominees by the Council to the members of the Academy for election.

Section 7. *Notification and Acceptance.* Each member-elect or foreign associate-elect shall, immediately following his election, be notified thereof in writing by the secretary. Each person elected to membership must accept the invitation, in writing, before the close of the next stated meeting of the Academy. Otherwise, on proof that the secretary has formally notified him of his election, his name shall not be entered on the roll of members.

A diploma, with the official seal of the Academy and the signatures of the officers, shall be supplied by the secretary to each member on his acceptance of membership and to foreign associates on their election.

Section 8. *Termination.* Resignation from membership shall be addressed to the president and acted on by the Council.

ARTICLE III. MEETINGS OF THE ACADEMY

Section 1. *Stated Meetings.* The Academy shall hold one stated meeting, called the annual meeting, in the second quarter of each year in the City of Washington, District of Columbia, and another stated meeting, called the autumn meeting, at a place to be determined by the Council. The Council shall also have the power to fix the date of each meeting. Written notice of the time and place of each meeting shall be given to each member of the Academy not less than thirty days prior thereto.

Section 2. *Annual Meeting.* The annual meeting shall consist of business sessions and technical sessions. At the business sessions, the meeting shall receive any reports deemed appropriate by the officers and the Council; shall consider matters referred to it by the Council, and shall transact such other business as may properly comcome before it. At the technical sessions, the meeting shall receive and discuss communications on engineering subjects.

Section 3. *Autumn Meeting.* If matters of business are included by the Council in the call of the autumn meeting, one part of the meeting shall consist of a business session. Otherwise, the autumn meeting shall consist solely of technical sessions.

Section 4. *Special Meetings.* The Council may call special meetings of the Academy at such times and places and for such purposes as it may designate in the notice of call. The Council shall give not less than thirty days' written notice of the time, place, and purpose of all special meetings.

Section 5. *Voting.* Each member and member emeritus of the Academy shall be entitled to one vote on each matter submitted to a vote at any meeting, but no member whose dues have been in arrears for a period of six months prior to the meeting shall be entitled to vote.

Section 6. *Quorum.* Forty members, present in person, shall constitute a quorum at any business session of a stated or special meeting.

ARTICLE IV. FISCAL YEAR

The fiscal year of the Academy shall be from July 1 of each year to June 30 of the year following.

ARTICLE V. COUNCIL

SECTION 1. *Membership; Term.* The Council of the Academy shall consist of the president, vice president, and treasurer of the Academy; the president of the National Academy of Sciences; the vice chairman of the National Research Council; and twelve members of the Academy to be elected by the membership. In addition, the immediate past president of the Academy shall be a member of the Council for a period of one year immediately following the conclusion of his term of office.

The terms of the twelve members of the Council who are elected by the membership shall be arranged on a staggered basis. Thereafter, at each annual meeting an appropriate number of members of the Academy shall be elected to the Council for a term not to exceed three years. No member of the Council, excluding officers, shall be elected for a total term of service in excess of six years. The term of each member of the Council shall expire at the close of the annual meeting at which a successor is elected, except that the term of a retiring president of the Academy shall expire one year after his retirement.

SECTION 2. *Vacancies.* Any vacancy on the Council between annual meetings may be filled by the majority of the remaining members of the Council. The person so elected shall serve until the next annual meeting of the Academy, at which time a successor shall be elected, as nearly as possible in accordance with Section 4 of Article VII of these bylaws, to fill the unexpired term.

SECTION 3. *Functions.* Subject to the provisions of the Articles of Organization of the Academy and these bylaws, the Council shall have paramount authority with respect to the funds, activities, policies, and purposes of the Academy. The Council shall have power to adopt the annual general budget of the Academy and to appoint and fix the salaries of the personnel who may be deemed necessary for the conduct of its affairs.

SECTION 4. *Meetings.* The Council shall meet immediately following the annual meeting of the Academy, and notice of such meeting shall not be required. The Council shall also meet at least three other times per year with the time and place of each meeting set forth in a written notice to all members of the Council at least ten days prior to the date of each meeting.

In addition, the Council shall hold such special meetings as the president or three members of the Council, by written request to the president, may call, at such time and place and for such purpose as is designated by the president or by those members who have called the meeting. The president shall give to all members of the Council not less than five days' written or three days' telegraphic notice of the time, place, and purpose of each special meeting.

Eight members of the Council shall constitute a quorum at all meetings thereof.

SECTION 5. *Executive Committee.* There shall be an Executive Committee of the Council, consisting of the president, vice president, and treasurer of the Academy; the president of the National Academy of Sciences; and four members appointed annually by, and from, the Council of the Academy. The president of the Academy shall be the chairman of the Executive Committee and the secretary of the Academy shall act as secretary of the Committee. Four members of the Committee shall constitute a quorum at all meetings thereof.

During intervals between meetings of the Council, the Executive Committee may exercise all the powers of the Council except that the Committee may not fill vacancies on the Council or among the officers of the Academy, exercise the powers of the Council with respect to nominations to membership in the Academy, or do any other acts that are expressly prohibited to the Committee by the Council.

The Executive Committee may, in the discretion of the president of the Academy, conduct any of its affairs by mail, telephonic, or telegraphic vote of all the members of such Committee, provided that any question so decided shall have been transmitted to every member of the Committee in the same wording. An affirmative vote of a majority of the Councillors shall be necessary for action, and all members of the Committee shall be appraised of the vote before the result of the poll on questions so submitted is recorded by the chairman.

The Executive Committee shall hold such meetings as the chairman or any three members of the Committee may by written request call, at such time and place and for such purposes as are designated by the chairman or by the three members who have called the meeting. The chairman shall give to every member of the Committee not less than five days' written or three days' telegraphic notice of the time, place, and purpose of each meeting of the Committee.

The Executive Committee shall keep regular minutes and shall report on its proceedings to the Council.

ARTICLE VI. OFFICERS

SECTION 1. *General.* The officers of the Academy shall be a president and a vice president, who shall be members of the Council, and such other officers, including a secretary and a treasurer (who need not be Academy members), as the Council from time to time may determine.

SECTION 2. *Election; Term.* The president, vice president, secretary, and treasurer shall be elected for a term of four years commencing with the close of the annual meeting at which their election is announced and ending with the close of the annual meeting at which the election of their successors is announced. The aforesaid officers shall be elected as specified in Section 4 of Article VII of these bylaws. In case of a vacancy the election shall be held as nearly as possible in the same manner prior to the next business meeting of the Academy and shall be for the unexpired term, except that a vacancy in the office of the treasurer or secretary may be filled by appointment of the president until the next business session of the Academy.

The president, vice president, secretary, and treasurer shall be elected for a term of four years commencing with the close of the annual meeting at which their election is announced and ending with the close of the annual meeting at which the election of their successors is announced. Any other offices created by the Council shall be filled by appointment of the Council, for such terms as the Council may determine.

SECTION 3. *Duties of Officers.*

a. *President.* The president shall be the chief executive officer of the Academy and, with the Council, shall direct the general business of the Academy. He shall preside at all meetings of the Academy and the Council. He shall submit a report each year of the activities of the Academy to the Council at its regular meeting next preceding the annual meeting and to the Academy at its annual meeting. He shall be ex officio a member of all standing committees, in addition to those committee members specified in Article VII of these bylaws. In general, he shall have all the powers and duties of supervision and management usually vested in the office of the president of any institution of this character.

b. *Vice President.* The vice president shall be vested with all the powers and required to perform all the duties of the president in his absence or during his disability and shall perform such other duties as may be prescribed by the Council. He shall be ex officio a member of all standing committees in addition to those committee members specified in Article VII of these bylaws.

c. *Secretary.* The secretary shall attend all meetings of the Academy and all meetings of the Council and the standing committees. He shall record all the proceedings of such sessions and meetings in a book or books kept for that purpose and, after approval by the Council, shall enter the minutes of business and technical meetings of the Academy in its permanent records.

He shall conduct and be responsible for the correspondence of the Academy, as directed by the Council and the president.

He shall acknowledge receipt of all contributions made to the Academy, shall keep records thereof, and shall report them promptly to the Council for its consideration. He shall keep a record of all grants of money and awards of prizes made by the Academy, in the form prescribed by the president and Council.

He shall give proper notice of all meetings of the Academy and the Council and of all nominations for officers, membership in the Council, and membership in the Academy.

He shall have custody of the seal of the Academy and shall affix it to all documents as authorized by the Council or the president.

d. *Treasurer.* The treasurer shall be responsible for all receipts and disbursements of the Academy; shall ensure that full and accurate accounts thereof are kept; and shall be responsible for the deposit, in such institutions as may be designated by the Council, of all monies, securities, and other valuable effects that are under the administration or control of the Academy. In fulfilling the foregoing responsibilities, he may use the services of the staff of the Academy or he may arrange for use of the services of the National Academy of Sciences. He shall give such bond as the Council may require.

He shall ensure that dues, assessments, and subscriptions are collected from the members and that appropriate records thereof are kept. He shall disburse the funds of the Academy as may be ordered by the Council or the president and shall render to the Council or the president, whenever it may be required, an account of all his transactions as treasurer.

Not later than the first day of December of each year, the treasurer shall prepare and submit to the Council a full report of the financial affairs of the Academy for the preceding fiscal year, including all receipts and disbursements. He shall also prepare and present to the Council at least sixty days prior to the annual meeting and to the Academy at its annual meeting a financial statement for that part of the current fiscal year ending on December 31.

SECTION 4. *Delegation of Duties of Officers.* In case of the absence or disability of any officer of the Academy or for any reason deemed sufficient by the Council, the powers or duties, or both, of such officer may be delegated by the Council to any other officer or member of the Council.

ARTICLE VII. COMMITTEES

SECTION 1. *Finance Committee.* There shall be a Finance Committee, consisting of the treasurer, the president of the National Academy of Sciences, and not more than six members of the Academy appointed annually by the president. The treasurer of the Academy shall be chairman of the Finance Committee. The Committee shall prepare and present to the Council the annual general budget of the Academy and shall determine matters relating to the purchase and sale of securities or other investments that are under the administration or control of the Academy. The Committee shall have the power, subject to the approval of the Council, to employ competent investment counsel to advise the Committee.

SECTION 2. *Auditing Committee.* At each annual meeting of the Academy the president shall appoint an Auditing Committee consisting of three members, one of whom shall be named by the president as chairman of the Committee. The Committee shall arrange for an audit, by independent certified public accountants, of the accounts of the Academy for the current fiscal year and shall present the report of audit to the Academy at the next annual meeting, together with such comments and recommendations as the Committee may deem appropriate. The Committee may cause to be made any other examinations of the financial records, the accounting records, and the system of internal control of the Academy that, in its judgment, are necessary for the determination of the adequacy and accuracy of the accounts of the Academy.

Section 3. *Committee on Membership.* There shall be a Committee on Membership, composed of not less than sixteen nor more than thirty members appointed by the Council, after taking into account the various branches of engineering represented in the Academy. The Council shall annually name the chairman and vice chairman of the Committee. The vice chairman shall, under normal circumstances, succeed to a one-year term as chairman.

The members of the Committee shall be appointed for terms of three years, each of which, as nearly as possible, shall be on a staggered basis. The functions of the Committee shall be to analyze the membership structures of the Academy, to originate nominations, and to appraise nominations received from the members.

Section 4. *Nominating Committee.* The president, with the approval of the Council, shall annually appoint a Nominating Committee composed of five members, one of whom shall be a member of the Council and one of whom shall be named as chairman, to prepare nominations to fill any vacancies that will occur in that year in the Council or among the officers of the Academy. There shall be a complete rotation of the members of the Committee each year, except that the chairman of the Committee in any given year shall automatically become a member (but not the chairman) of the Committee for the following year; and no member of the Committee may serve again until three years after his term has expired.

Not less than ninety days prior to the opening of the annual meeting in each year, any group of not less than forty members of the Academy may, by written petition presented directly to the Council, suggest the name of a person to be nominated to any given post. Any such petition shall be referred by the secretary to the Nominating Committee for its comments. Not less than sixty days prior to the opening of the annual meeting, the Nominating Committee shall report to the Council the Committee's list of nominations, together with its comments on any suggestions made by petition. Not less than forty-five days prior to the opening of the annual meeting, the Council, after considering the Committee's report and any suggestions made by petition, shall nominate one person for each post to be filled. The Secretary shall promptly submit this list of nominations to the members of the Academy for voting by unsigned, confidential mail ballots, each such ballot to contain a provision for write-in votes. The elections shall be determined by the ballots received not less than fourteen days prior to the opening of the annual meeting. After expiration of the time specified for receiving the ballots, the secretary shall open the ballots and tabulate the results, which shall be announced at the annual meeting.

Section 5. *Project Committee.* There shall be a Project Committee composed of not less than ten nor more than twenty members appointed by the president, which shall recommend the initiation of studies and organization of symposia and conferences by the Academy, shall review requests for studies and investigations and recommend to the Council suitable action on each, and shall perform such other duties in connection with the programs of the Academy as the Council may direct. The members of the Committee shall be appointed for terms of three years, each of which, as nearly as possible, shall be on a staggered basis.

Section 6. *Other Committees.* The Council or the president may appoint such other committees, composed of members of the Academy or or nonmembers, or both, as shall be deemed appropriate to carry out the purposes of the Academy and shall define the function and authority of each committee, within the limitation of this Article VII.

Section 7. *General.* Except as otherwise provided in these bylaws, any committee may, in the discretion of its chairman, conduct any of its affairs by mail, telephonic, or telegraphic vote of all the members of such committee, provided that any question so decided shall first have been transmitted to every member of the committee in the same wording. An affirmative vote of a majority of the committee shall be necessary for action, and all members of the committee shall be apprised of the vote before the chairman of the committee records the result of the poll on the question so submitted.

A majority of the members of a committee shall constitute a quorum at all meetings thereof.

ARTICLE VIII. REPORTS AND PUBLICATIONS

SECTION 1. *Annual Report.* After the close of each fiscal year, the secretary shall prepare an annual report containing a record of the activities of the Academy during that fiscal year, including a copy of the treasurer's report. After approval by the Council, this report shall be transmitted to the president of the National Academy of Sciences and shall be transmitted to the members of the National Academy of Engineering at the annual meeting next following.

SECTION 2. *Other Reports and Publications.* The Academy may arrange for the issuance of such other reports and publications as may be desirable.

ARTICLE IX. AMENDMENTS

Amendments to these bylaws may be made only by the members of the Academy by action taken at any stated or special meeting by a majority of the votes cast, provided that the amendment has been proposed by resolution adopted at a previous meeting of the Academy, by resolution adopted by the Council, or by written proposal signed by forty members of the Academy; and provided also that notice of the proposed amendment has been sent to all members of the Academy not less than thirty days prior to the meeting at which the amendment is presented for action.

ARTICLE X. PARLIAMENTARY PROCEDURE

The rules contained in *Robert's Rules of Order* shall govern the Academy in all cases to which they are applicable and in which they are not inconsistent with the bylaws or the special rules of order of this Academy.

ORGANIZATION OF THE ACADEMY

July 1, 1975—June 30, 1976

OFFICERS

	Term Expires
President: Courtland D. Perkins	(1978)
Vice President: William E. Shoupp	(1978)
Treasurer: Edward N. Cole	(1978)
Secretary: J. H. Mulligan, Jr.	(1978)

COUNCIL

Arthur E. Bryson, Jr. (1977)[1]
Robert H. Cannon, Jr. (1978)
W. Kenneth Davis (1978)[1]
John H. Dessauer (1976)
Richard G. Folsom (1978)[1]
Edward L. Ginzton (1977)
Robert C. Gunness (1977)
Frederic A. L. Holloway (1976)
Ralph Landau (1979)
W. Deming Lewis (1978)
Joseph M. Pettit (1976)
Morris Tanenbaum (1977)[1]
Courtland D. Perkins, *ex officio* (1978)[1]
William E. Shoupp, *ex officio* (1978)[1]
Edward N. Cole, *ex officio* (1978)[1]
Philip Handler, *ex officio* (1978)[1 2]

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[1] Member of the Executive Committee of the Council.
[2] Not a member of the Academy of Engineering.

(All member terms expire at end of Annual Meeting of year indicated.)

Members elected at the 1976 Annual Meeting: Frederic A. L. Holloway (1977), Joseph M. Pettit (1979), and Samuel C. Phillips (1979).

Executive Committee of the Council for 1976–1977: W. Kenneth Davis, Richard G. Folsom, Edward L. Ginzton, and Ralph Landau.

NAE Representatives on Governing Board: Courtland D. Perkins, President; William E. Shoupp, Vice President; Frederic A. L. Holloway, and Morris Tanenbaum.

MEMBERS OF THE ACADEMY

Abramson, H. Norman (1976), Vice President, Engineering Sciences Division, Southwest Research Institute, P.O. Drawer 28510, San Antonio, Texas 78284

Ackermann, William C. (1967), Chief, Illinois State Water Survey, P.O. Box 232, Urbana, Illinois 61801

Adcock, Willis A. (1974), Vice President, Texas Instruments Inc., P.O. Box 6015, Dallas, Texas 75222

Adler, Robert (1967), Vice President and Director of Research, Zenith Radio Corp., 6001 West Dickens Avenue, Chicago, Illinois 60639

Agnew, Harold M. (1976), Director, Los Alamos Scientific Laboratory of the University of California, P.O. Box 1663, Los Alamos, New Mexico 87545

Agnew, William G. (1974), Technical Director, General Motors Research Laboratories, 12 Mile and Mound Roads, Warren, Michigan 48090

Allen, Clarence R. (1976), Professor of Geology and Geophysics, Seismological Laboratory 252-21, California Institute of Technology, Pasadena, California 91125

Allen, H. Julian (1966), (Retired Director, Ames Research Center, NASA), 769 Melville Avenue, Palo Alto, California 94301

Alvarez, Luis W. (1969), Professor of Physics, Lawrence Berkeley Laboratory, The University of California, Berkeley, California 94720

Amdahl, Gene M. (1967), Chairman of the Board of Directors, Amdahl Corp., 1250 East Arques Avenue, Sunnyvale, California 94086

Amundson, Neal R. (1970), Regents' Professor of Chemical Engineering and Head, Department of Chemical Engineering and Materials Science, The University of Minnesota, Minneapolis, Minnesota 55455

Ancker-Johnson, Betsy (1975), Assistant Secretary of Commerce for Science and Technology, U.S. Department of Commerce, 14th and Constitution Avenue, N.W., Room 3864, Washington, D.C. 20230

Anderson, Arthur G. (1975), IBM Vice President and President of General Products Division, IBM Corporation, Monterey and Cottle Roads, San Jose, California 95193

Ang, Alfredo H-S. (1976), Professor of Civil Engineering, University of Illinois at Urbana—Champaign, 3129e Civil Engineering Building, Urbana, Illinois 61801

Aris, Rutherford (1975), Professor and Head, Department of Chemical Engineering and Materials Science, The University of Minnesota, Minneapolis, Minnesota 55455

Arnold, Philip M. (1970), Vice President, Phillips Petroleum Company, 332 Frank Phillips Building, Bartlesville, Oklahoma 74004

Arnold, William Howard, Jr. (1974), General Manager, Pressurized Water Reactor Systems Division, Westinghouse Electric Corporation, Nuclear Center, Box 355, Pittsburgh, Pennsylvania 15230

Ashley, Holt (1970), Professor, Department of Aeronautics/Astronautics, Stanford University, Durand Building, Room 369, Stanford, California 94305

Atkin, Rupert L. (1975), Director of Engineering, Chassis Components, TRW Automotive Worldwide, 34201 Van Dyke, Warren, Michigan 48092

Atwood, J. Leland (1974), (Retired President and Chief Executive, Rockwell International Corp.), P.O. Box 90343, Airport Station, Los Angeles, California 90009

Auerbach, Isaac L. (1974), President, Auerbach Corp. for Science and Technology, 121 North Broad Street, Philadelphia, Pennsylvania 19107

Austin, James B. (1967), (Retired Administrative Vice-President, United States Steel Corp.), 114 Buckingham Road, Pittsburgh, Pennsylvania 15215

Avila, Charles F. (1968), (Corporate Director, Retired Chairman of the Board, Boston Edison Company), 272 Atlantic Avenue, Swampscott, Massachusetts 01907

Babb, Albert L. (1972), Professor and Chairman, Department of Nuclear Engineering; Professor of Chemical Engineering, The University of Washington, 303 Benson Hall, BF-10, Seattle, Washington 98195

Bachman, Walter C. (1967), (Retired Vice President and Chief Engineer, Gibbs and Cox, Inc.), Wayside, Short Hills, New Jersey 07078

Bacon, Vinton W. (1969), Professor of Civil Engineering, The University of Wisconsin—Milwaukee, 3200 North Cramer Street, EMS Building, Room E 332, Milwaukee, Wisconsin 53201

Bailey, Stuart L. (1973), Consultant, Atlantic Research Corporation, 5390 Cherokee Avenue, Alexandria, Virginia 22314

Bainer, Roy (1965), Dean Emeritus, College of Engineering, The University of California, Bainer Hall, Room 3030, Davis, California 95616

Baird, Jack A. (1971), Vice President, American Telephone and Telegraph Company, 195 Broadway, Room 2639, New York, New York 10007

Baker, Robert A., Sr. (1967), (Retired Executive Vice President, Public Service Electric and Gas Company), 285 Clinton Place, Hackensack, New Jersey 07601

Baker, W. O. (1975), President, Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974

Ballhaus, William F. (1973), President, Beckman Instruments, Inc., 2500 Harbor Boulevard, Fullerton, California 92634

Banks, Harvey O. (1973), President, Harvey O. Banks, Consulting Engineer, Inc., 3 Kittie Lane, Belmont, California 94002

Bardeen, John (1972), Professor of Electrical Engineering and Physics, Department of Physics, The University of Illinois—Urbana, Urbana, Illinois 61801

Barlow, Edward J. (1968), President, Instrument Group, Varian Associates, 611 Hansen Way, Palo Alto, California 94303

Barnes, Howard C. (1974), Vice President, Electrical Energy and Environmental Systems, Chas. T. Main, Inc., Southeast Tower, Prudential Center, Boston, Massachusetts 02199

Barr, Harry F. (1965), (Retired Vice President, Engineering Staff, General Motors Corp.), 25620 Meadowdale Lane, Franklin, Michigan 48025

Barrow, Thomas D. (1974), Director and Senior Vice President, Exxon Corp., 1251 Avenue of the Americas, New York, New York 10020

Baruch, Jordan J. (1974), Lecturer on Business Administration, Faculty Member, Harvard University, Graduate School of Business Administration, Morgan Hall, Room 4, Boston, Massachusetts 02163

Battin, Richard H. (1974), Associate Department Head, Charles Stark Draper Laboratory, Inc., 75 Cambridge Parkway, Cambridge, Massachusetts 02142

Bauer, Benjamin B. (1974), Vice President, CBS Laboratories, 227 High Ridge Road, Stamford, Connecticut 06905

Bauer, Robert F. (1969), Chairman of the Board, Global Marine Inc., 811 West Seventh Street, Los Angeles, California 90017

Baxter, Samuel S. (1970), Consulting Engineer, 7048 Castor Avenue, Philadelphia, Pennsylvania 19149

Beard, Leo R. (1975), Technical Director, Center for Research in Water Resources, University of Texas at Austin, Route 4, Box 189, Austin, Texas 78757

Beattie, Horace S. (1976), Consultant, IBM, IBM Corporation, 740 New Circle Road, Lexington, Kentucky 40511

Bechtel, Stephen D., Jr. (1975), Chairman, Bechtel Group of Companies, 50 Beale Street, P.O. Box 3965, San Francisco, California 94119

Beckman, Arnold O. (1967), Chairman of the Board, Beckman Instruments, Inc., 2500 Harbor Boulevard, Fullerton, California 92634

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AGES OF MEMBERS—AGE DISTRIBUTION OF PRESENT MEMBERS

Year born	Age in 1976	Number of members, 1976
1886 to 1895	90–81	8
1896 to 1901	80–75	30
1902 to 1907	74–69	87
1908 to 1913	68–63	156
1914 to 1919	62–57	163
1920 to 1925	56–51	152
1926 to 1931	50–45	81
1932 to 1938	44–38	7
Total		684

GEOGRAPHICAL DISTRIBUTION OF MEMBERS

	Number of members, 1976
State:	
Alabama	1
Arizona	4
Arkansas	1
California	165
Colorado	8
Connecticut	15
Delaware	2
District of Columbia	38
Florida	12
Georgia	1
Hawaii	3
Idaho	1
Illinois	43
Indiana	9
Iowa	1
Kansas	2
Kentucky	2
Maryland	9
Massachusetts	67
Michigan	18
Minnesota	8
Missouri	8
New Hampshire	3
New Jersey	47
New Mexico	5
New York	63
North Carolina	6
Ohio	16
Oklahoma	3
Pennsylvania	45
Rhode Island	1
South Carolina	1
Tennessee	4
Texas	31
Utah	4
Vermont	2
Virginia	12
Washington	13
Wisconsin	6
Outside of United States:	
Belgium	1
England	1
Switzerland	1
Thailand	1
Total	684

AFFILIATION DISTRIBUTION OF MEMBERS

Affiliation	Number of members, 1976
Industrial	267
Academic	235
Governmental	46
Consulting	51
Retired	71
Other	14
Total	684

AWARDS OF THE ACADEMY

Name	Awards	Year
Engstrom, Elmer William	Steinmetz	1965
Bush, Vannevar	Founders	1966
McDonnell, James Smith	do	1967
Zworykin, Vladimir Kosma	do	1968
Nyquist, Harry	do	1969
Draper, Charles S	do	1970
Johnson, Clarence L	do	1971
Land, Edwin H	do	1972
Sutherland, Ivan E	Zworykin	1972
Lewis, Warren K	Founders	1973
Bitzer, Donald L	Zworykin	1973
Jonsson, J. Erik	Founders	1974
Giaever, Ivar	Zworykin	1974
Fisk, James B	Founders	1975
Kilby, Jack S	Zworykin	1975
Benedict, Manson	Founders	1976
Patel, C. Kumar	Zworykin	1976

PRESIDENTS OF THE ACADEMY

Augustus Braun Kinzel	December 1964–April 1966.
Eric Arthur Walker	April 1966–April 1970.
Clarence H. Linder	April 1970–May 1973.
Robert C. Seamans, Jr	May 1973–1974.
Courtland D. Perkins	May 1975–.

DECEASED MEMBERS

	Date of birth	Date of election	Date of death
Ammann, Othmar Herman	Mar. 26, 1879	April 1965	Sept. 22, 1965
Chilton, Thomas H	Aug. 14, 1899	1966	Sept. 15, 1972
Dryden, Hugh Latimer	July 2, 1898	Founding member	Dec. 2, 1965
Fair, Gordon M	July 27, 1894	1967	Feb. 11, 1970
Fenske, Merrell R	June 5, 1904	1967	Sept. 28, 1971
Ferri, Antonio	Apr. 5, 1912	1967	Dec. 28, 1975
Furnas, Clifford Cook	Oct. 22, 1900	1967	Apr. 27, 1969
Gaudin, Antoine M	Aug. 8, 1900	April 1964	Aug. 23, 1974
Gibbs, William Francis	Aug. 24, 1886	October 1965	Sept. 6, 1967
Gilbreth, Lillian M	May 24, 1878	do	Jan. 2, 1972
Gilliland, Edwin R	July 10, 1909	April 1965	Mar. 10, 1973
Heald, Henry T	Nov. 8, 1904	Oct. 1965	Nov. 23, 1975
Heffner, Hubert	Dec. 26, 1924	April 1971	Apr. 1, 1975
Ippen, Arthur T	July 28, 1907	1967	Apr. 5, 1974
Jenks, Stephen M	Feb. 18, 1901	1968	Apr. 12, 1974
Kelly, Clarence J	Oct. 18, 1906	1968	May 5, 1976
Kyle, John M., Jr	Dec. 3, 1904	1967	Sept. 30, 1970
Lewis, Warren K	Aug. 21, 1882	April 1966	Mar. 9, 1975
McGauhey, Percy H	Jan. 20, 1904	1973	Oct. 8, 1975
Mentzer, William C	May 27, 1907	1968	Dec. 23, 1971
Millikan, Clark Blanchard	Aug. 23, 1903	Founding member	Jan. 2, 1966
Molnar, Julius P	Feb. 23, 1916	1969	Jan. 11, 1973
Morton, Jack A	Sept. 4, 1913	1967	Dec. 10, 1971
Prutton, Carl F	July 30, 1908	1966	July 15, 1970
Schwartzwalder, Karl	May 5, 1907	April 1970	May 2, 1975
Sherwood, Thomas K	July 25, 1903	Founding member	Jan. 14, 1976
Sikorsky, Igor I	May 25, 1889	1968	Oct. 26, 1972
Souders, Mott	Dec. 10, 1904	April 1970	Dec. 11, 1974
Whitman, Walter G	Nov. 30, 1895	1974	Apr. 6, 1974
Wilhelm, Richard Herman	Jan. 1, 1909	1968	Aug. 6, 1968

COMMITTEES OF THE ACADEMY

AUDITING COMMITTEE

Established December 10, 1964

"The Committee shall arrange for an audit, by independent certified public accountants, of the accounts of the Academy for the current fiscal year and shall present the report of audit to the Academy at the next annual meeting, together with such comments and recommendations as the Committee may deem appropriate. The Committee may cause to be made any other examination of the financial records, the accounting records, and the system of internal control of the Academy which, in its judgment, is necessary for the determination of the adequacy and accuracy of the accounts for the Academy."

Chairman, Daniel J. Fink. *Members:* George H. Brown, Thomas O. Paine, Courtland D. Perkins (*ex officio*, President NAE), and William E. Shoupp (*ex officio*, Vice President, NAE). (Terms expire at close of Annual Meeting, April 1977.)

AWARDS COMMITTEE

Established April 29, 1965

"The Committee shall formulate general policies regarding awards and honors administered by the National Academy of Engineering and shall submit such policies and specific recommendations for approval by the Council. The Committee shall formulate a general program designed to meet the needs and desires of the Academy in the matter of awards and honors and shall implement the establishment of new awards and honors, as may be approved by the Council. The Committee shall select, subject to approval by the Council, the recipients of existing awards and honors. The Committee shall make plans for a Founders Lecture to be held annually or from time to time at the National Academy of Engineering by an individual known for his outstanding contributions to engineering and shall make recommendations to the Council as to policies and procedures to be followed in implementing such plans."

Chairman, Alan M. Lovelace. *Members:* Malcolm R. Currie, C. Chapin Cutler, Louis H. Roddis, Jr., Ascher H. Shapiro, Thomas K. Sherwood, John W. Simpson, and Abel Wolman. (Terms expire at close of Annual Meeting, April 1976.)

Chairwoman, Ruth M. Davis. *Members:* James W. Daily, Donald G. Fink, Edwin L. Harder, Rudolf Kompfner, Nunzio J. Palladino, and J. George Thon. (Terms expire at close of Annual Meeting, April 1977.)

BIOGRAPHICAL MEMOIRS COMMITTEE

Established October 20, 1965

"The Committee shall prepare in an appropriate fashion the Biographical Memoirs of the National Academy of Engineering."

To be appointed.

FINANCE COMMITTEE

Established December 10, 1964

"The Committee shall prepare and present to the Council the annual general budget of the Academy and shall determine matters relating to the purchase and sale of securities or other investments which are under the administration or control of the Academy. The Committee shall have the power, subject to the approval of the Council, to employ competent investment counsel to advise the Committee."

Chairman, Edward N. Cole. *Members:* Stephen D. Bechtel, Jr., Richard G. Folsom, John D. Harper, Thomas C. Kavanagh, W. Deming Lewis, Howard S. Turner, Courtland D. Perkins (*ex officio*, President, NAE), William E. Shoupp (*ex officio*, Vice President, NAE), and Philip Handler (*ex officio*, President, NAS). (Terms expire at close of Annual Meeting, April 1976.)

Chairman, Edward N. Cole. *Members:* Betsy Ancker-Johnson, Stephen D. Bechtel, Jr., Richard G. Folsom, Hugh S. Knowles, Gordon H. Millar, Theodore J. Nagel, Courtland D. Perkins (*ex officio*, President, NAE), William E. Shoupp (*ex officio*, Vice President, NAE), and Philip Handler (*ex officio*, President, NAS). (Terms expire at close of Annual Meeting, April 1977.)

NAS/NAE JOINT BOARD

Established December 10, 1964

> "The Council of the National Academy of Engineering and the Council of the National Academy of Sciences shall each select an equal number of persons to serve as a Joint Board to recommend policies and modes of operation for accomplishing the most effective cooperation between the two Academies and to perform such other functions as may be assigned to it by joint action of the Councils of the two Academies."

NAE Members: Robert W. Cairns, John H. Dessauer, and Frederic A. L. Holloway. (Terms expire at close of Annual Meeting, April 1976.)

NAE Members: W. Kenneth Davis, John H. Dessauer, and Frederic A. L. Holloway. (Terms expire at close of Annual Meeting, April 1977.)

COMMITTEE ON MEMBERSHIP

Established December 10, 1964

> "The Committee shall meet, as directed by its chairman, to analyze the membership structure of the Academy, to originate nominations, and to appraise nominations received from the members."

Chairman, John R. Kiely (1976), *Vice Chairman*, Nathan Cohn (1976). *Members:* Robert A. Baker, Sr. (1978), Robert Bromberg (1978), Robert W. Cairns (1976), Paul F. Chenea (1976), C. Chapin Cutler (1976), Daniel C. Drucker (1976), Phillip Eisenberg (1978), Morris E. Fine (1977), Kenneth W. Hamming (1978), George A. Hawkins (1976), Willis M. Hawkins (1976), Robert I. Jaffee (1976), James R. Johnson (1978), Thomas C. Kavanagh (1976), Chalmer G. Kirkbride (1977), John J. McKetta, Jr. (1976), George E. Mueller (1976), Daniel A. Okun (1978), Louis H. Roddis, Jr. (1978), Philip N. Ross (1976), Milton C. Shaw (1977), John W. Simpson (1976), Ronald Smelt (1978), and Thornton A. Wilson (1978). (NAE Thirteenth Edition)

Chairman, Nathan Cohn (1977). *Vice Chairman*, Paul F. Chenea (1977). *Members:* W. Howard Arnold, Jr. (1979), Albert L. Babb (1977), Robert A. Baker, Sr. (1978), Robert Bromberg (1978), Arthur M. Bueche (1979), Morris Cohen (1979), C. Chapin Cutler (1979), Robert M. Drake, Jr. (1977), Mildred S. Dresselhaus (1977), Phillip Eisenberg (1978), Morris E. Fine (1977), Harold B. Gotaas (1977), William R. Gould (1977), Kenneth W. Hamming (1978), Arthur E. Humphrey (1977), James R. Johnson (1978), Wendell E. Johnson (1978), Chalmer G. Kirkbride (1977), Eugene F. Murphy (1977), Daniel A. Okun (1978), Charles E. Reed (1979), Robert B. Richards (1979), Louis H. Roddis, Jr. (1978), Milton C. Shaw (1977), Ronald Smelt (1978), John R. Whinnery (1977), and Thornton A. Wilson (1978). (NAE Fourteenth Election)

NOMINATING COMMITTEE

Established December 10, 1964

> "Not less than 30 days prior to the annual meeting in each year, the Committee shall submit to the secretary, for transmission to the membership, nominations to fill any vacancies which will occur in that year in the Council or officers."

Chairman, Martin Goland. *Members:* Betsy Ancker-Johnson, Edward L. Ginzton, Paul E. Gray, and Thomas C. Kavanagh. (Terms expire at close of Annual Meeting, April 1976.)

Chairman, Howard S. Turner. *Members:* W. Kenneth Davis, Martin Goland, Robert I. Jaffee, and John R. Kiely. (Terms expire at close of Annual Meeting, April 1977.)

COMMITTEES OF THE ACADEMIES/NATIONAL RESEARCH COUNCIL

> "The National Academy of Engineering undertakes certain activities jointly with the National Academy of Sciences and the National Research Council. Further information on these joint committees can be found in the annual reports of the National Academy of Sciences and the National Research Council.

APPENDIX III

INSTITUTE OF MEDICINE

ANNUAL MEETING, 1975

The fifth autumn meeting of the Institute of Medicine was held on November 5, 6, and 7, 1975, in the auditorium of the National Academy of Sciences Building in Washington, D.C. A special introductory session for members elected in 1975 was held on the afternoon of November 5, followed by a business session for all members. November 6 and 7 were devoted to a forum on "Implications of Guaranteeing Medical Care." There was no second general meeting planned in the fiscal year.

BUSINESS SESSION

A number of election issues were submitted to the members present for consideration and discussion: the desired professional structure of the Institute, including the procedure for classification and optimal composition of the Institute upon achievement of the maximum membership of 400, and the proposed means of attaining the election of given numbers of candidates in specified groups; the process of electing members for a second five-year term; and a proposed bylaw amendment to address the foregoing.[1]

A draft of the 1976 IOM Program Plan, outlining the categories of program development and activity for the coming year, was presented for discussion and critique. Members' comments were referred to the Program Committee for their use in revising the draft plan prior to submission to the IOM Council for approval. The status of ongoing projects also was briefly reviewed.

TECHNICAL SESSIONS

The forum on "Implications of Guaranteeing Medical Care," held November 6–7, 1975, represented one of many activities the Institute will undertake, in accordance with a grant from the Andrew W. Mellon Foundation, on important ethical and legal issues in medicine.

The participants were asked to examine the implications entailed in a social commitment to equity in medical care. Four main subject areas were each addressed by a principal speaker, followed by selected respondents and commentators. These topics included a critical review of the concept of medical care as a social right, an analysis of the economics of choice in guaranteeing medical care services, a review of the roles for medical care providers, and examination of health promotion efforts when guarantees for medical care services have been met. The papers and commentary have been published.

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[1] Section I of the Institute Bylaws was amended by vote of the membership in December, 1975.

SESSION I

OPENING COMMENTS BY THE PRESIDENT OF THE INSTITUTE OF MEDICINE

David A. Hamburg

THE CONCEPT OF MEDICAL CARE AS A SOCIAL RIGHT: A CRITICAL REVIEW

Charles Fried, Professor of Law, Harvard University, Cambridge, Massachusetts.

RESPONSE

David Mechanic, Professor of Sociology and Director, Center for Medical Sociology and Health Services Research, University of Wisconsin, Madison.

MEDICAL CARE GUARANTEES: THE ECONOMICS OF CHOICE

Thomas Schelling, Professor of Economics, Harvard University; Director, Public Policy Program, Kennedy School of Government, Cambridge, Massachusetts.

RESPONSE

Robert M. Ball, Senior Scholar, Institute of Medicine, Washington, D.C.

COMMENTARY

John L. S. Holloman, Jr., President, New York City Health and Hospitals Corporation.

Karen Davis, Senior Fellow, The Brookings Institution, Washington, D.C.

Walter J. McNerney, President, Blue Cross Association, Chicago, Illinois.

SESSION II

A SOCIETAL COMMITMENT TO EQUITY: ROLES FOR THE MEDICAL CARE PROVIDER

Robert G. Petersdorf, Professor and Chairman, Department of Medicine, School of Medicine, University of Washington, Seattle.

RESPONSE

Eliot Freidson, Professor, Department of Sociology, New York University.

COMMENTARY

Harry Schwartz, Member, Editorial Board, The New York Times.

Loretta C. Ford, Dean, School of Nursing, University of Rochester Medical Center, Rochester, New York.

SMALL-GROUP DISCUSSIONS

Discussions by Institute members of the program topics and a staff paper on national health goals and strategies.

THE RESPONSIBILITIES OF THE GOVERNMENT: THE LEGISLATIVE VIEWPOINT

Edward M. Kennedy, United States Senator.

SESSION III

MEDICAL CARE AS A RIGHT: THE CANADIAN EXPERIENCE

Marc Lalonde, Minister of National Health and Welfare, Government of Canada, Ottawa.

RESPONSE

James F. Dickson III, Acting Deputy Assistant Secretary for Health, Department of Health, Education, and Welfare, Washington, D.C.

COMMENTARY

Melvin A. Glasser, Director, Social Security Department, United Auto Workers International Union, Detroit, Michigan.

PLENARY SESSION AND REPORT OF SMALL-GROUP DISCUSSION LEADERS

Roger J. Bulger, Executive Officer, Institute of Medicine, Washington, D.C.

Dorothy P. Rice, Director, National Center for Health Statistics, Rockville, Maryland.

Chester M. Pierce, Professor of Education and Psychiatry, Harvard University, Cambridge, Massachusetts.

Cecil G. Sheps, Vice Chancellor, Health Sciences; Professor of Social Medicine, University of North Carolina at Chapel Hill.

Open discussion followed. The meeting was adjourned at the noon hour on November 7.

ELECTION

Recognizing the need for adequate representation of all disciplines which contribute constructively to the goals of the Institute, the Council approved a new mechanism of informal, preferential balloting on proposed candidates for the guidance of the Membership Committee in its formulation of the final ballot. In December, 1975, all proposed candidates were divided into a number of professional classes; the classes employed were: natural scientists, fundamental and applied; social scientists, fundamental and applied; health administrators, academic and "other"; clinical practitioners, medical and "other"; and one category for those not included in the foregoing. The names of all candidates in each class were then submitted to all voting members in that class for preferential voting, and the results were referred to the Membership Committee for the final decision on the number of new members to be elected and the quota for each class.

In January 1976, the Membership Committee drew up a formal slate of 48 nominees. For the first time, an entirely structured ballot was issued with provision for the election of a given number of candidates in each class, as authorized through amendment of Bylaw I.2. Twenty-five prospective members were approved by the Council of the NAS on June 26 for appointment to the Institute by the NAS president. By action of the Institute's Council, the effective date of election of the 25 new members will be January 1 following their election, rather than July 1 as in the past; the term of all incumbent members was extended six months to end on December 31 rather than on June 30 as in the past. As a consequence, no new members will be added in 1976. As of June 30, there were 304 active and 12 senior members [two having been added to the senior ranks in January, 1976].

In addition to the election of new members, the Institute also conducted its first re-election of incumbent members in fiscal 1976. Ninety-one charter members and members elected in 1971 were due to complete an initial five-year term in the IOM on December 31, 1976. In November, a poll was conducted to determine each person's willingness to stand for re-election. Of the 91 members questioned, 21 chose to transfer to the senior roster rather than stand for a second five-year term. The remaining 70 members were re-elected in April. Three other people, in addition to the 21 mentioned above, will join the senior ranks in January by virtue of having reached the mandatory age limit on active membership. As a result of these processes, the total membership as of January 1, 1977, will stand at 305 active and 36 senior members.

The following were elected to an initial term of five years, effective January 1, 1977:

Robert J. Blendon, Roger J. Bulger, George E. Burket, Jr., Robert A. Burt, John A. Clausen, Karen Davis, Jack Elinson, Alvan R. Feinstein, William C. Felch, Eugene A. Hildreth, John K. Iglehart, Jay Katz, Samuel L. Kountz, Boris Magasanik, Audrey Forbes Manley, Jack D. Myers, Jack Orloff, Nora Piore, Lee N. Robins, Richard S. Ross, Charles A. Sanders, John F. Sherman, Burton A. Weisbrod, Jack E. White, Sr., and T. Franklin Williams.

CHARTER AND BYLAWS

PREAMBLE

The growth of knowledge in the health sciences has greatly expanded the capabilities of medicine. Rising expectations of better health and of improved quality of life for all members of our society now include good health care as a universal human right and as a goal of this society. The provision of such care places increasingly heavy demands on health services and on their complex relations with other sectors of society. The resulting expansion of requirements for health manpower and the continuing need to provide for further scientific progress present grave challenges to our medical and social institutions. These developments have generated the need for a national institution, composed of individuals of distinction and achievement, committed to the advancement of the health sciences and education and to the improvement of health care.

CHARTER

Under the terms of its charter, the National Academy of Sciences is enjoined to marshal the scientific and technical wisdom of the United States in the national interest, particularly to provide advisory services to departments of the United States government. The problems posed in provision of health services are so large, complex and important as to require, for their solution, the concern and competences not only of medicine, but also of other disciplines and professions. To provide an instrument adequate to these complex problems, and as an indication of the great significance of health care in our national life, the Council of the National Academy of Sciences hereby authorizes the creation of the Institute of Medicine. This Institute shall be broadly based in medicine and the medical sciences, and related aspects of such other fields as the behavioral and social sciences, administration, law and engineering. The Institute of Medicine shall be concerned with the protection and advancement of the health of the public, including, *inter alia:* the provision of health care; education for the health and medical professions and sciences; and the promotion of biomedical research and development.

In the pursuit of this purpose, the Institute of Medicine will

(1) identify, for study and analysis, important issues and problems that relate to health and medicine;

(2) prepare authoritative statements on these issues and problems when, in the judgment of the Institute, such statements would be in the interest of the public;

(3) initiate and conduct studies largely concerned with broad aspects of national policy and planning for health care and health related education and research;

(4) develop proposals for specific studies, generally concerned with the technical, substantive aspects of medical care or its scientific basis, by the National Research Council or other bodies;

(5) review, at the request of the President of the National Academy of Sciences, programs, proposals and reports generated by the National Research Council;

(6) respond to requests from the federal government and other agencies for studies and advice on matters relating to health and medicine;

(7) establish liaison with the major scientific and professional societies concerned with health and medicine;

(8) identify appropriate individuals to serve on study groups operating under the aegis of other units of the NAS/NRC; and

(9) disseminate information to the public and the relevant professions.

I.

Membership

1. The membership of the Institute shall consist of not more than four hundred (400) persons selected from the fields of health and medicine—clinical medicine, medical education, the medical sciences, nursing, dentistry and other health professions—and from other fields related to health and medicine such as the natural, social and behavioral sciences, law, administration, government service and engineering. No more than three-quarters of the members shall be drawn from the fields of health and medicine.

2. Membership in the Institute shall be based upon

a. Professional achievement in a medical, scientific or other professional field and the relevance of such achievement to the problems of medicine; and

b. Demonstrated interest, concern and involvement with problems and critical issues in health care, prevention of disease, medical education and medical research; and

c. Expressed willingness to commit a significant portion of time to work, within the Institute, on such problems or issues.

3. The charter membership of the Institute shall consist of those members of the Board on Medicine who signify their desire and willingness to accept the responsibilities of membership in the Institute, together with those members of the Section on Medical Sciences of the National Academy of Sciences who similarly signify their desire and willingness to accept the responsibilities of membership in the Institute and are within the age limitations for membership specified below. Within six months of the formal activation of the Institute, the Council shall nominate a number of qualified individuals sufficient to bring the total membership to no more than one hundred (100), subject to the approval of the Council of the National Academy of Sciences for appointment by the President of the Academy. In subsequent years, the members of the Institute shall elect additional members, subject to the approval of the President and the Council of the National Academy of Sciences.

4. Members shall be elected for a term of five years, and may be reelected for not more than one additional term of five years. Upon completing the number of terms for which he has been elected, or at the end of the calendar year in which he reaches

his sixty-sixth birthday, whichever is the earlier, a member shall become a Senior Member. Senior Members shall not be counted in the authorized total of membership. They may participate in all the activities of the Institute, except that they shall not be officers or members of the Council, nor shall they cast a vote in the affairs of the Institute.

II.

Officers and Committees

1. The governance of the Institute shall be the responsibility of the officers and committees noted below. In each instance, initiative in the selection of such individuals shall rest with the Institute; appointment to these positions shall be made by the President of the National Academy of Sciences.

2. A Council consisting of twenty-one (21) members shall serve as the governing body of the Institute.

3. The initial membership of the Council shall consist of those members of the Board on Medicine who signify their desire and willingness to accept the responsibilities of membership in the Institute and service on its Council. Initial members shall be designated by lot to serve for a term of one, two, or three years, one-third of the membership to serve for each term, respectively. Vacancies on the Council shall be filled by election by the membership of the Institute, for a term of three years. Members may be elected to successive terms. No more than three-fourths of the members shall be selected from the fields of health and medicine.

4. An Executive Committee of the Council will act for the Council in the interim between meetings of the Council.

5. The Executive Committee will be composed of five (5) members of the Council, designated at the beginning of each year by the President with the approval of the Council. The President of the Institute shall serve as chairman of the Executive Committee.

6. At least one member shall be from a field other than the health professions.

7. The Committee will meet on call by the President.

8. Actions of the Executive Committee are subject to ratification by the Council.

9. The President of the Institute shall be a full-time paid officer nominated by the Council and appointed by the President of the National Academy of Sciences with the approval of the Council of the National Academy of Sciences. He shall normally serve an initial term of no more than five years, renewable by the same appointive procedure. He shall employ such other persons as are necessary for the business of the Institute, subject to the approval of the Council.

10. The President of the Institute shall serve as Chairman of the Council. The Council may elect from its membership such other officers as it may wish to designate.

11. Subject to the approval of the Council, the President shall appoint a Program Committee, a Membership Committee, and a Finance Committee and shall make appropriate provision for rotation of membership on these committees. The President may appoint such other internal committees as he deems appropriate.

12. The membership of Committees conducting studies and preparing reports for dissemination outside the National Academy of Sciences shall be subject to review by the President of the Academy.

III.

Program and Budget

1. With the advice of the Program Committee, the President shall annually prepare and submit to the Council of the Institute and to the Council of the National Academy of Sciences for approval a program of studies to be conducted by the Institute, including ongoing studies. Subject to appropriate financing, the President shall have authority to

make arrangements for the conduct of such studies as are contained within the approved program.

2. With the approval of the Council of the Institute and of the President of the National Academy of Sciences, the President of the Institute shall make appropriate arrangements for the release of reports of studies, including interim reports. Approval by the Council shall constitute certification of the scientific competence and validity of such reports and recommendation for their public release.

3. With the advice of the Finance Committee, the President shall prepare and submit to the Council at least once a year a budget for the operations of the Institute, including the costs of individual studies. The Council shall forward its recommended budget for approval to the President and the Council of the National Academy of Sciences. The President is authorized to expend and to delegate the expenditure of funds within the currently approved budget. Between annual budgetary submissions, the President may be authorized by the President, National Academy of Sciences to make expenditures outside the previously authorized budget, provided financing is assured.

4. In consultation with the President of the National Academy of Sciences and the Council of the Institute, the President of the Institute shall engage in appropriate fund raising activities including development of an endowment for support of the activities of the Institute.

5. Through its President and staff, the Institute shall maintain appropriate liaison with all units of the National Research Council and maintain a special relationship with the Division of Medical Sciences of the National Research Council (NRC). The Chairman of the Division of Medical Sciences, NRC, shall be an *ex officio* member of the Council of the Institute and shall also serve as member and chairman of a four-member joint Institute-NRC committee. The other members of the joint committee shall be: the President of the Institute, one member of its Council, and a fourth member to be appointed by the President of the National Academy of Sciences. This committee must approve all projects to be conducted for the Institute by the Division of Medical Sciences, NRC. In the event there should be significant disagreement concerning the initiation of a project, the issue shall be decided by the President and Council of the National Academy of Sciences. A member of the Council of the Institute, to be elected by the Council of the Institute, shall serve as a member of the executive committee of the Division of Medical Sciences, NRC.

6. Programs which are undertaken by the Institute outside of the United States or which have substantial international implications shall be developed and operated in consultation with the Foreign Secretary of the National Academy of Sciences.

IV.

ANNUAL REPORT

1. The President shall prepare an annual report on the work of the Institute, and shall submit it, through the Council, to the President and Council of the National Academy of Sciences no later than two months after the conclusion of each fiscal year.

V

AMENDMENTS AND BYLAWS

1. This charter may be amended by mutual agreement between the Council of the National Academy of Sciences and the Council of the Institute, acting for a majority of the membership, as ascertained either at an annual meeting or by mail ballot.

2. The Council is authorized to prepare a set of Bylaws consistent with this charter and to propose amendments to such Bylaws from time to time, subject to the approval of a majority of those voting either at an annual meeting of the membership or by mail ballot.

VI.

EFFECTIVE DATE

1. This charter shall take effect on a date specified by the President of the National Academy of Sciences not more than sixty days after it is approved by the Council of the National Academy of Sciences.

2. All authorities and responsibilities vested in the Board on Medicine will be transferred to the Institute of Medicine as of that date.

BYLAWS

I.

ELECTION OF MEMBERS

1. Immediately after the activation of the Institute, the Council shall designate an initial Membership Committee. Within ninety (90) days from the activation of the Institute, the initial Membership Committee shall prepare a list of candidates containing at least fifty (50) percent more names than the number of places designated by the Council to be filled in the initial election. This list shall be voted on by the Council within sixty (60) days after it is submitted; the nominees receiving the highest number of votes, up to the number of places designated and subject to the limitations of the proportion of members from the medical and health professions, shall be deemed to be elected, subject to review by the Council, National Academy of Sciences.

2. Thereafter, annually, the Membership Committee shall prepare a list of nominees containing at least fifty (50) percent more names than the number of places designated by the Council to be filled, unless the Council determines that no election of new members shall be held in that year. Thereupon, the President shall cause a mail ballot accompanied by appropriate biographical information to be prepared and circulated to the membership. The President may, on instructions from the Council, issue a ballot divided into one or more categories with upper limits set for each category. The categories and the limits for each election shall be determined by the Council on the recommendations of the Membership Committee. The number of candidates in each category shall likewise be at least fifty (50) percent greater than the number to be elected in the category. Each member may vote for a number of candidates up to the maximum specified for each category, or, if the ballot is not divided, up to the total number to be elected. Candidates receiving the largest number of votes up to the total number designated, or up to the limit indicated for a particular category in a divided ballot, and subject to the overall limitation of the proportion of members from the medical and health professions, shall be deemed to be elected, as above. No candidate shall be elected, however, who does not receive at least twenty-five (25) percent of the total votes cast in an election. If the ballot is divided, the limitation on the proportion of members from the medical and health professions shall be applied by arranging all of the successful candidates from the various categories in rank order according to the number of votes received [including only those who receive at least 25 percent of the votes cast] and eliminating those candidates from the health and medical professions who received the lowest number of votes, substituting the next highest candidates not from the health and medical professions [provided all those candidates received at least 25 percent of the votes cast], to the extent necessary to assure that no more than seventy-five (75) percent of the resulting total membership comes from the health and medical professions.

3. Annually, after review by the Council of the list of members eligible for re-election, the President shall ascertain whether each member is willing to stand for re-election or prefers to adopt Senior Member status. The members standing for re-election shall be listed on a separate ballot which shall provide for a yes or no vote. A member shall be considered re-elected if a majority of the total votes he or she receives is affirmative.

Those who do not stand for re-election or are not re-elected shall become Senior Members.

II.

OFFICERS AND COUNCIL

1. The President of the Institute shall be selected by the initial Council as soon as possible after the activation of the Institute. If no appointment has been made within ninety (90) days, the Council shall elect one of their number Acting President until such time as a President shall take office.

2. The willingness of members of the Board on Medicine to become members of the initial Council of the Institute shall be determined in advance of the date of activation of the Institute. Nominations for vacancies occurring on the Council shall be made by the Council by the last day of September and mail ballots shall be distributed to the membership thereafter, returnable by the last day of November. Names may be added to the ballot by petition, signed by ten (10) percent of the membership, and timely notice of such opportunity shall be provided to the membership.

III.

MEETINGS

1. There shall be an annual meeting of the membership of the Institute to be held in Washington, D.C., or at such other place designated by the Council.

2. The Council shall meet not less than six times a year.

3. The substantive program of the Institute shall be presented annually for consideration at a meeting of the Institute.

Charter and Bylaws approved by the Council of the National Academy of Sciences on August 24, 1970, and amended February 1972, January 1973, and December 1975.

The Institute of Medicine was activated on December 17, 1970.

ORGANIZATION OF THE INSTITUTE

January 1, 1976

OFFICERS

President—David A. Hamburg [1]
Executive Officer—Roger J. Bulger [2]

COUNCIL

Robert M. Ball (1977)
E. L. Burwell (1978)
Guido Calabresi (1976)
Robert A. Chase [1] (1978)
Leon Eisenberg (1977)
Alain C. Enthoven [1] (1977)
Melvin A. Glasser (1977)
Bernard G. Greenberg (1977)
Robert J. Haggerty (1977)
Howard H. Hiatt (1976)
Peter Barton Hutt (1978)
Albert L. Lehninger (1978)
Dorothy P. Rice (1976)
Julius Richmond [1] (1978)
Walter A. Rosenblith [1] (1976)
Lisbeth Bamberger Schorr [1] (1977)
Nathan J. Stark (1976)
Daniel C. Tosteson (1978)
Joseph F. Volker (1976)
Kerr L. White (1976)
Paul A. Marks, *ex officio*
Adam Yarmolinsky, *ex officio*

(Terms end on December 31 of the year indicated)

IOM Representatives on Governing Board: David A. Hamburg, President; Walter A. Rosenblith, designee from the Council at large.

MEMBERS

(as of June 30, 1976)

Abdellah, Faye G., 1975, Assistant Surgeon General, Chief Nurse Officer, Director, Office of Nursing Home Affairs, U.S. Public Health Service, Department of Health, Education and Welfare, Parklawn Building, Room 17B-07, 5600 Fishers Lane, Rockville, Maryland 20852

Abelson, Philip H., 1973, President, Carnegie Institution of Washington, 1530 P Street, N.W., Washington, D.C. 20005

Ahrens, E.H., Jr., 1973, Professor, The Rockefeller University, 66th Street and York Avenue, New York, New York 10021

Alberty, Robert A., 1973, Professor of Chemistry and Dean, School of Science, Massachusetts Institute of Technology, Room 6-215, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

Anderson, Odin W., 1973, Professor and Director, Center for Health Administration Studies, University of Chicago, 5720 South Woodlawn Avenue, Chicago, Illinois 60637

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[1] Member of Executive Committee.
[2] Resigned on Jan. 31, 1976; Karl D. Yordy, senior program officer, was named Acting Executive Officer as Feb. 1, 1976.

Andreoli, Kathleen G., 1972, Associate Professor of Nursing, Department of Medicine, University of Alabama Medical Center, University Station, Birmingham, Alabama 35294

Anlyan, William G., 1971, Vice President for Health Affairs, Duke University Medical Center, Durham, North Carolina 27710

Armistead, W. W., 1973, Dean, College of Veterinary Medicine, Box 1071, University of Tennessee, Knoxville, Tennessee 37901

Arrow, Kenneth J., 1974, Professor of Economics, Project on Efficiency of Decision Making in Economic Systems, Harvard University, 1737 Cambridge Street, Room 401, Cambridge, Massachusetts 02138

Austen, W. Gerald, 1974, Professor of Surgery, Chief, Surgical Services, Harvard Medical School, Massachusetts General Hospital, Department of Surgery, Fruit Street, Boston, Massachusetts 02114

Aydelotte, Myrtle K., 1973, Director, Department of Nursing, University of Iowa Hospitals and Clinics, The University of Iowa, Iowa City, Iowa 52242

Baker, William O., 1972, President, Bell Telephone Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974

Ball, Robert M., 1974, Scholar-in-Residence, Institute of Medicine, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

Barger, A. Clifford, 1974, Robert Henry Pfeiffer Professor of Physiology and Chairman, Department of Physiology, Harvard Medical School, 25 Shattuck Street, Boston, Massachusetts 02115

Barnes, Allan C., 1971, Vice President, The Rockefeller Foundation, 1133 Avenue of the Americas, New York, New York 10036

Barondess, Jeremiah A., 1971, Clinical Professor of Medicine, Cornell University Medical College, 449 East 68th Street, New York, New York 10021

Bateman, Mildred Mitchell, 1973, Director, West Virginia Department of Mental Health, State Capitol, Charleston, West Virginia 25305

Bearn, Alexander G., 1971, Professor and Chairman, Department of Medicine, The New York Hospital—Cornell Medical Center, 525 East 68th Street, New York, New York 10021

Beddingfield, Edgar T., Jr., 1973, Practitioner of Medicine, Wilson Clinic, Wilson, North Carolina 27893

Bennett, Ivan L., Jr.,* 1970, Director, New York University Medical Center, 550 First Avenue, New York, New York 10016

Berg, Paul, 1974, Willson Professor of Biochemistry, Department of Biochemistry, Stanford University Medical Center, Stanford, California 94305

Berliner, Robert W., 1971, Dean, School of Medicine, Yale University, 333 Cedar Street, New Haven, Connecticut 06510

Branscomb, Lewis M., 1975, Vice President and Chief Scientist, IBM Corporation, Old Orchard Road, Armonk, New York 10504

Branson, Herman R., 1975, President, Lincoln University of the Commonwealth System of Higher Education, Lincoln University, Pennsylvania 19352

Braunwald, Eugene, 1974, Hersey Professor of the Theory and Practice of Physic (Medicine), Harvard Medical School, Physician-in-Chief, Peter Bent Brigham Hospital, 721 Huntington Avenue, Boston, Massachusetts 02115

Breslow, Lester, 1975, Dean, UCLA School of Public Health, Center for Health Sciences, University of California, Los Angeles, California 90024

Bricker, Neal S., 1975, Professor and Chairman, Department of Internal Medicine, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Bronx, New York 10461

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*Denotes Charter Members.

Brooks, Harvey, 1973, Dean of Engineering and Applied Physics, 217 Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Bryant, John H., 1971, Joseph R. DeLamar Professor of Public Health, Director, School of Public Health, Faculty of Medicine, Columbia University, 600 West 168th Street, New York, New York 10032

Bryant, Thomas E., 1972, President, The Drug Abuse Council, 1828 L Street, N.W., Washington, D.C. 20036

Burns, John J., 1971, Vice President for Research, Hoffman-La Roche, Inc., Nutley, New Jersey 07110

Burwell, E. L., 1971, Internist in Private Practice, Falmouth Medical Associates, Four Bramblebush Park, Falmouth, Massachusetts 02540

Busse, Ewald W., 1972, Associate Provost and Director, Medical and Allied Health Education, Duke University Medical Center, Box 3005, Durham, North Carolina 27710

Butler, Lewis H., 1973, Adjunct Professor of Health Policy, Health Policy Program, University of California School of Medicine, San Francisco, California 94143

Calabresi, Guido, 1973, John Thomas Smith Professor of Law, Yale Law School, Drawer 401A, Yale Station, New Haven, Connecticut 06520

Calhoun, Noah R., 1975, Chief, Dental Service and Dental Research, Veterans Administration Hospital, 688/160, 50 Irving Street, N.W., Washington, D.C. 20422

Callahan, Daniel, 1972, Director, Institute of Society, Ethics and the Life Sciences, 623 Warburton Avenue, Hastings-on-Hudson, New York 10706

Carey, William D., 1974, Executive Officer, American Association for the Advancement of Science, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036

Cassel, John C., 1975, Professor, Department of Epidemiology, School of Public Health, University of North Carolina, Chapel Hill, North Carolina 27514

Chalmers, Thomas C., 1974, President and Dean, Mt. Sinai Medical Center, Fifth Avenue and 100th Street, New York, New York 10029

Chapman, Carleton B., 1972, President, The Commonwealth Fund, One East 75th Street, New York, New York 10021

Chase, Robert A., 1971, President and Director, National Board of Medical Examiners, Professor of Surgery, University of Pennsylvania and Stanford University, National Board of Medical Examiners, 3930 Chestnut Street, Philadelphia, Pennsylvania 19104

Cherkasky, Martin, 1971, Director, Montefiore Hospital and Medical Center, 111 East 210th Street, Bronx, New York 10467

Christman, Luther, 1972, Dean, College of Nursing and Allied Health Sciences, Rush University, Rush-Presbyterian—St. Luke's Medical Center, 1725 West Harrison Street, Chicago, Illinois 60612

Cobb, Jewel P., 1974, Dean, Connecticut College, New London, Connecticut 06320

Cobbs, Price M., 1972, 3528 Sacramento Street, San Francisco, California 94118

Cohen, Seymour S., 1973, American Cancer Society Professor of Microbiology, Department of Microbiology, University of Colorado School of Medicine, Denver, Colorado 80220

Cohen, Wilbur J., 1972, Professor and Dean, School of Education, The University of Michigan, Ann Arbor, Michigan 48104

Coles, Ana B., 1974, Professor and Dean, Howard University College of Nursing, 2400 Sixth Street, N.W., Washington, D.C. 20059

Coles, Robert, 1973, Research Psychiatrist, Harvard University Health Services, 75 Mt. Auburn Street, Cambridge, Massachusetts 02138

Collen, Morris F., 1971, Director, Medical Methods Research, The Permanente Medical Group and the Kaiser Foundation Research Institute, 3778 Piedmont Avenue, Oakland, California 94611

Comroe, Julius H.,* 1970, Herzstem Professor of Biology, University of California, San Francisco, California 94143

Cooke, Robert E., 1971, Vice Chancellor for Health Sciences and Professor of Pediatrics, University of Wisconsin-Madison, Room 1007-WARF Office Building, 610 North Walnut Street, Madison, Wisconsin 53706

Cooper, John A. D., 1972, President, Association of American Medical Colleges, Suite 200, One Dupont Circle, N.W., Washington, D.C. 20036

Cooper, Theodore, 1974, Assistant Secretary for Health, Department of Health, Education and Welfare, HEW-N, Room 5077, 330 Independence Avenue, S.W., Washington, D.C. 20201

Cox, Jerome R., Jr., 1971, Director, Biomedical Computer Laboratory, Washington University School of Medicine, 700 South Euclid Avenue, St. Louis, Missouri 63110

Cromwell, Florence S., 1975, Adjunct Associate Professor, Department of Occupational Therapy, University of Southern California, 12933 Horton Avenue, Downey, California 90242

Cronkhite, Leonard W., Jr., 1975, President, The Children's Hospital Medical Center, 300 Longwood Avenue, Boston, Massachusetts 02115

Cross, Harold D., 1971, Main Road, Hampden Highlands, Maine 04445

Crow, James F., 1973, Professor and Chairman, Medical Genetics, Genetics Building, University of Wisconsin, Madison, Wisconsin 53706

Cummings, Martin M., 1975, Director, National Library of Medicine, 8600 Rockville Pike, Bethesda, Maryland 20014

Daddario, Emilio Q., 1972, Office of Technology Assessment, 119 D Street, N.E., Room A727, Washington, D.C. 20510

Danforth, William H., 1971, Chancellor, Washington University, St. Louis, Missouri 63130

Daniels, Arlene Kaplan, 1974, Professor, Department of Sociology and Director, Program on Women, 619 Emerson, Northwestern University, Evanston, Illinois 60201

Davis, Bernard D., 1975, Adele Lehman Professor of Bacterial Physiology, Bacterial Physiology Unit, Harvard Medical School, 25 Shattuck Street, Boston, Massachusetts 02115

Denenberg, Herbert S., 1973, Columnist, Philadelphia Bulletin and Consumer Expert, WCAU-TV (CBS) Philadelphia, P.O. Box 146, Wynnewood, Pennsylvania 19096

Densen, Paul M., 1972, Director, Center for Community Health and Medical care, Harvard University, 643 Huntington Avenue, Boston, Massachusetts 02115

Detweiler, David K., 1974, Professor of Physiology, Director, Comparative Cardiovascular Studies Unit, University of Pennsylvania, School of Veterinary Medicine, 3800 Spruce Street, Philadelphia, Pennsylvania 19104

Deuschle, Kurt W., 1971, Ethel H. Wise Professor of Community Medicine and Chairman of the Department, Mount Sinai School of Medicine, Fifth Avenue and 100th Street, New York, New York 10029

Dickson, James F., III, 1971, Deputy Assistant Secretary for Health, Department of Health, Education and Welfare, Washington, D.C. 20201

Djerassi, Carl, 1973, Professor of Chemistry, Stanford University Department of Chemistry, Stanford, California 94305

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*Denotes Charter Members.

Dole, Vincent P., 1971, Professor and Senior Physician, Rockefeller University Hospital, 66th Street and York Avenue, New York, New York 10021

Donabedian, Avedis, 1971, Professor of Medical Care Organization, University of Michigan School of Public Health, 109 Observatory Street, Ann Arbor, Michigan 48104

Dorfman, Albert, 1973, Professor of Pediatrics and Biochemistry, University of Chicago, 950 E. 59th Street, Chicago, Illinois 60637

Dowda, F. William, 1971, 490 Peachtree Street, N.E., Atlanta, Georgia 30308

Dummett, Clifton O., 1972, Associate Dean for Extramural Affairs, Professor and Chairman, Department of Community Dentistry, University of Southern California, School of Dentistry, P.O. Box 77006, Los Angeles, California 90007

DuVal, Merlin K., 1973, Vice President, Health Sciences, University of Arizona, Tucson, Arizona 85724

Ebert, James D., 1974, Director, Department of Embryology, Carnegie Institution of Washington, 115 West University Parkway, Baltimore, Maryland 21210

Ebert, Robert H., 1971, Dean of the Faculty of Medicine, The Harvard Medical School, 25 Shattuck Street, Boston, Massachusetts 02115

Edwards, Adrian L., 1973, Practitioner of Internal Medicine and Cardiology, Clinical Assistant Professor of Medicine, Cornell University Medical College, 135 East 71st Street, New York, New York 10021

Eisdorfer, Carl, 1975, Professor and Chairman, Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, Washington 98195

Eisen, Herman N., 1974, Professor Immunology, E17–128 Center for Cancer Research, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

Eisenberg, Leon, 1973, Maude and Lillian Presley Professor and Chairman, Executive Committee, Department of Psychiatry, Harvard Medical School, Senior Associate in Psychiatry, Children's Hospital Medical Centre, Boston, Massachusetts 02115

Elam, Lloyd C., 1971, President, Meharry Medical College, 1005 18th Avenue, North, Nashville, Tennessee 37208

Ellis, Effie O., 1972, Consultant and Co-Director, Quality of Life Center, 300 North State Street, Chicago, Illinois 60610

Ellwood, Paul M., Jr., 1974, President, INTERSTUDY, 123 East Grant Street, Minneapolis, Minnesota 55403

English, Joseph T., 1971, Director of Psychiatry, St. Vincent's Hospital and Medical Center of New York, 144 West 12th Street, New York, New York 10011

Enthoven, Alain C., 1972, Marriner S. Eccles Professor of Public and Private Management, Graduate School of Business, Stanford University, Stanford, California 94305

Estabrook, Ronald W., 1975, Virginia Lazenby O'Hara Professor, Chairman of Biochemistry Department, and Dean, Graduate School of Biomedical Sciences, University of Texas Health Science Center, 5323 Harry Hines Boulevard, Dallas, Texas 75235

Estes, E. Harvey, 1972, Professor and Chairman, Department of Community Health Sciences, Duke University Medical Center, Durham, North Carolina 27710

Evans, John R., 1973, President, University of Toronto, Toronto, Ontario, Canada, M5S 1A1

Farber, Saul J., 1975, The Nathan Friedman Professor and Cha[illegible], Department of Medicine, New York University School of Medicine, Direct[illegible], Medicine, Bellevue Hospital, Director, Medicine, University Hospital, New York University School of Medicine, 550 First Avenue, New York, New York 10016

Fein, Rashi,* 1970, Professor of the Economics of Medicine, Center for Community Health and Medical Care, Harvard Medical School, 643 Huntington Avenue, Boston, Massachusetts 02115

Feldstein, Martin S., 1971, Professor of Economics, Harvard University, Department of Economics, 1737 Cambridge Street, Cambridge, Massachusetts 02138

Fischer, A. Alan, 1971, Professor and Chairman, Department of Family Medicine, Indiana University School of Medicine, 1100 West Michigan Street, Indianapolis, Indiana 46202

Fleming, Scott, 1974, Senior Vice President and Regional Manager, Oregon Region, Kaiser-Permanente Medical Care Program, 1500 S.W. First Avenue, Portland, Oregon 97201

Ford, Loretta C., 1971, Dean, School of Nursing, Director of Nursing, University Medical Center, University of Rochester, 601 Elmwood Avenue, Rochester, New York 14642

Foster, Henry W., 1972, Professor and Chairman, Department of Obstetrics and Gynecology, Meharry Medical College, 1005 18th Avenue, North, Nashville, Tennessee 37208

Fox, Renee C., 1975, Professor and Chairman, Department of Sociology, Professor of Sociology, Department of Medicine, Professor of Sociology, Department of Psychiatry, University of Pennsylvania, 128 McNeil Building, Philadelphia, Pennsylvania 19174

Frederickson, Donald S., 1971, Director, National Institutes of Health, 9000 Rockville Pike, Bethesda, Maryland 20014

Freedman, Daniel X., 1974, Louis Block Professor of Biological Sciences and Chairman, Department of Psychiatry, The University of Chicago, 950 East 59th Street, Chicago, Illinois 60637

Freidson, Eliot, 1972, Professor, New York University, Graduate School of Arts and Sciences, Department of Sociology, 19 University Place, Room 300, New York, New York 10003

Fuchs, Victor R., 1971, Professor of Economics, Stanford University, Vice President, Research, National Bureau of Economic Research, 204 Junipero Serra Boulevard, Stanford, California 94305

Galagan, Donald J., 1974, 148 Lone Tree Road, Edgewood Bay, Lakeview, Arkansas 72642

Gamble, John R., 1974, Chairman, Department of Medicine, Pacific Medical Center, P.O. Box 7999, San Francisco, California 94120

Garwin, Richard L., 1975, Fellow, IBM Corporation, Thomas J. Watson Research Center, IBM Corporation, P.O. Box 218, Yorktown Heights, New York 10598

Gell-Mann, Murray, 1974, Professor of Theoretical Physics, California Institute of Technology, 452-48, Pasadena, California 91109

Ginzberg, Eli, 1972, Director, Conservation of Human Resources, Columbia University, New York, New York 10027

Giorgi, Elsie A., 1973, Practitioner of Medicine, Associate Clinical Professor of Medicine and Community Medicine, University of California at Los Angeles, 153 South Lasky Drive, Suite No. 3, Beverly Hills, California 90212

Glaser, Robert J.,* 1970, President, Henry J. Kaiser Family Foundation, Two Palo Alto Square, Palo Alto, California 94304

Glasser, Melvin A., 1974, Director, Social Security Department, United Auto Workers, International Union, 8000 East Jefferson Avenue, Detroit, Michigan 48214

Good, Robert A.,* 1970, President and Director, Sloan-Kettering Institute for Cancer Research, 1275 York Avenue, New York, New York 10021

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*Denotes Charter Members.

Gottschalk, Carl W., 1973, Career Investigator, American Heart Association, Kenan Professor of Medicine and Physiology, Department of Medicine, The University of North Carolina, Chapel Hill, North Carolina 27514

Greenberg, Bernard G., 1972, Dean, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514

Greenlick, Merwyn R., 1971, Director, The Health Services Research Center, Kaiser Foundation Hospitals, 4610 S.E. Belmont Street, Portland, Oregon 97215

Grobe, James L., 1973, Practitioner of Medicine, 136 East Desert Park Lane, Phoenix, Arizona 85020

Haggerty, Robert J., 1972, Roger I. Lee Professor of Public Health, Head Department of Health Policy and Management, Harvard School of Public Health, Professor of Pediatrics, Harvard Medical School, 677 Huntington Avenue, Boston, Massachusetts 02115

Halberstam, Michael, 1973, Practitioner of Medicine, Assistant Clinical Professor of Medicine, George Washington University Medical School, 2520 L Street, N.W. Washington, D.C. 20036

Halpern, Charles R., 1972, Executive Director, Council for Public Interest Law, 1250 Connecticut Avenue, N.W., Washington, D.C. 20036

Hamburg, David A., 1971, President, Institute of Medicine, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

Harrington, Donald C., 1972, Medical Director, Foundation for Medical Care of San Joaquin County, 540 East Market Street, P.O. Box 230, Stockton, California 95201

Harris, LaDonna, 1972, President, Americans for Indian Opportunity, Incorporated, 1816 Jefferson Place, N.W., Washington, D.C. 20036

Haughton, James G., 1972, Executive Director, Health and Hospitals Governing Commission of Cook County, 1900 West Polk Street, Chicago, Illinois 60612

Haviland, James W., 1973, Practitioner of Medicine, Clinical Professor of Medicine, Associate Dean for Clinical Affairs, University of Washington School of Medicine, Seattle, Washington 98195

Hawthorne, Edward W., 1972, Dean, Graduate School of Arts and Sciences, Howard University, Washington, D.C. 20059

Hayes, George J., 1972, Major General MC USA, Principal Deputy Assistant Secretary of Defense (Health and Environment), Office of the Secretary of Defense, Room 3E172 Pentagon, Washington, D.C. 20301

Haynes, M. Alfred, 1973, Professor and Chairman, Department of Community Medicine, Charles R. Drew Postgraduate Medical School, 1621 East 120th Street, Los Angeles, California 90059

Haywood, H. Carl, 1972, Professor of Psychology and Special Education, The John F. Kennedy Center for Research on Education and Human Development, George Peabody College for Teachers, (Professor of Neurology, Vanderbilt University), Box 40, Nashville, Tennessee 37203

Henderson, Maureen, 1974, Assistant Vice President for Health Affairs, University of Washington, Seattle, Washington 98195

Hershey, Nathan, 1972, Professor of Health Law, Department of Health Services Administration, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania 15261

Hess, Arthur E., 1974, Consultant—Program and Administration (formerly Deputy Commissioner of Social Security), 4805 Woodside Road, Baltimore, Maryland 21229

Heyssel, Robert M., 1972, Executive Vice President and Director, The Johns Hopkins Hospital, 601 North Broadway, Baltimore, Maryland 21205

Hiatt, Howard H., 1971, Dean, Harvard School of Public Health, Professor of Medicine, Harvard Medical School, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115

Hill, Genevieve T., 1975, Dean, School of Social Work, Atlanta University, 223 Chestnut Street, S.W., Atlanta, Georgia 30314

Hirsch, James G., 1974, Dean of Graduate Studies, Professor and Senior Physician, The Rockefeller University, New York, New York 10021

Hobbs, Nicholas, 1974, Professor of Psychology, Director of Center for the Study of Families and Children, Vanderbilt University, Nashville, Tennessee 37240

Hogness, John R., 1971, President, University of Washington, 301 Administration Building, AH-30, Seattle, Washington 98195

Holloman, John L. S., 1972, President, New York City Health and Hospitals Corporation, 125 Worth Street, New York, New York 10013

Hutt, Peter Barton, 1971, Covington and Burling, 888 16th Street, N.W., Washington, D.C. 20006

Ingram, Alvin J., 1971, Chief, The Campbell Clinic, Chairman of Orthopedics, University of Tennessee College of Medicine, 869 Madison Avenue, Memphis, Tennessee 38104

Isselbacher, Kurt J., 1974, Mallinckrodt Professor of Medicine, Harvard Medical School, and Chief, Gastrointestinal Unit, Massachusetts General Hospital, Boston, Massachusetts 02114

Jacobson, Leon O.,* 1970, Director, The Franklin McLean Memorial Research Institute and Joseph Regenstein Professor of Biological and Medical Sciences, University of Chicago, Franklin McLean Memorial Research Institute, Box 420, 950 East 59th Street, Chicago, Illinois 60637

Johnson, Jean E., 1974, Professor and Director, Center for Health Research, College of Nursing, Wayne State University, 5557 Cass Avenue, Detroit, Michigan 48202

Kaplan, Henry S., 1972, Maureen Lyles D'Ambrogio Professor of Radiology and Oncology, Director, Cancer Biology Research Laboratory, Department of Radiology, Stanford University Medical Center, Stanford, California 94305

Keene, Clifford H., 1971, Past President, Kaiser Foundation Hospitals, Whitman Lane, Box 961, Pebble Beach, California 93953

Kelly, James F., 1974, Executive Vice Chancellor, State University of New York, 99 Washington Avenue, Albany, New York 12210

Kempe, C. Henry, 1972, Professor and Chairman, Department of Pediatrics, University of Colorado Medical Center, 4200 East Ninth Avenue, Denver, Colorado 80220

Kennedy, Donald, 1971, Professor, Department of Biological Sciences, Stanford University, Stanford, California 94305

Kennedy, Eugene P., 1971, Hamilton Kuhn Professor of Biological Chemistry, Harvard Medical School, Boston, Massachusetts 02115

Kerr, I. Lawrence, 1975, Practitioner of Dentistry, Dental Wing, Medical Arts Building, Endicott, New York 13760

Kety, Seymour S., 1973, Professor of Psychiatry, Harvard Medical School, Massachusetts General Hospital, Boston, Massachusetts 02114

Kibrick, Anne, 1971, Director, Department of Nursing, Boston State College, 625 Huntington Avenue, Boston, Massachusetts 02115

Kipnis, David M., 1974, Professor and Chairman, Department of Medicine, Washington University School of Medicine, Physician-in-Chief, Barnes Hospitals, 660 South Euclid Avenue, St. Louis, Missouri 63110

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*Denotes Charter Members.

Kirklin, John W., 1972, Fay Fletcher Kerner Professor of Surgery and Chairman, Department of Surgery, School of Medicine and the Medical Center, University of Alabama Medical School, University Station, Birmingham, Alabama 35294

Klarman, Herbert E., 1971, Professor of Economics, Graduate School of Public Administration, New York University, Four Washington Square North, New York 10003

Knowles, John H., 1971, President, The Rockefeller Foundation, 1113 Avenue of the Americas, New York, New York 10036

Krevans, Julius R., 1975, Professor of Medicine and Dean, School of Medicine, University of California, San Francisco, California 94143

Kunkel, Henry G.,* 1970, Professor, The Rockefeller University, New York, New York 10016

Lambertson, Eleanor C., 1973, Dean, Cornell University-New York Hospital School of Nursing, Associate Hospital Director—Nursing Service, The New York Hospital-Cornell Medical Center, 525 East 68th Street, Room G–104, New York, New York 10021

Lasagna, Louis, 1971, Professor of Pharmacology and Toxicology, University of Rochester, School of Medicine and Dentistry, 260 Crittenden Boulevard, Rochester, New York 14642

Lederberg, Joshua, 1971, Professor of Genetics, Stanford University School of Medicine, Stanford, California 94305

Lee, Philip R., 1971, Director, Health Policy Program, 1326 Third Avenue, University of California, San Francisco, California 94143

Leffall, LaSalle D., Jr., 1973, Professor and Chairman, Department of Surgery, Howard University College of Medicine, Washington, D.C. 20060

Lehninger, Albert L., 1974, DeLamar Professor and Director, Department of Physiological Chemistry, Johns Hopkins University School of Medicine, 725 North Wolfe Street, Baltimore, Maryland 21205

Levine, Sol, 1975, University Professor of Sociology and Community Medicine, Boston University, 270 Bay State Road, Boston, Massachusetts 02215

Levinthal, Cyrus, 1974, William R. Kenen Professor of Biological Sciences, Department of Biological Sciences, Columbia University, 754 Schermerhorn, New York, New York 10027

Lewis, Charles E., 1973, Professor of Medicine, Public Health and Nursing, Department of Medicine, School of Medicine, University of California, Los Angeles, California 90024

Lewis, Irving J., 1971, Professor, Department of Community Health, Albert Einstein College of Medicine, Yeshiva University, 1300 Morris Park Avenue, Bronx, New York 10461

Lilienfeld, Abraham M., 1974, Distinguished Service Professor of Epidemiology, Johns Hopkins University School of Hygiene and Public Health, 615 North Wolfe Street Baltimore, Maryland 21205

Lindheim, Roslyn, 1971, Professor of Architecture, College of Environmental Des[illegible] University of California at Berkeley, Wurster Hall 390, Berkeley, California 8[illegible]

Lindzey, Gardner, 1975, Director, Center for Advanced Study in the Behavi[illegible] [illegible]ences, 202 Junipero Serra Boulevard, Stanford, California 94305

London, Irving B.,* 1970, Director, Harvard-MIT Program in Health Sciences and Technology, MIT 16–512, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

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*Denotes Charter Members.

Long, Robert C., 1974, Director, Division of Human Sexuality, University of Louisville School of Medicine, Associate Professor, Department of Obstetrics and Gynecology, University of Louisville School of Medicine, Private Practitioner in Gynecology and Marital-Sexual Counseling, Suite 406-Watterson Towers, 1930 Bishop Lane, Louisville, Kentucky 40218

Lubic, Ruth Watson, 1971, General Director, Maternity Center Association, 48 East 92nd Street, New York, New York 10028

Luria, S. E., 1971, Department of Biology, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Lythcott, George I., 1972, Associate Vice Chancellor, Professor of Pediatrics, University of Wisconsin Madison Health Sciences Center, 1007 WARF Building, 610 North Walnut Street, Madison, Wisconsin 53706

MacMahon, Brian, 1973, Professor of Epidemiology and Head of the Department, 89 Warren Street, Needham, Massachusetts 02192

Maccoby, Eleanor E., 1975, Professor and Chairman, Department of Psychology, Stanford University, Stanford, California 94305

Mahoney, Margaret E., 1973, Vice President, The Robert Wood Johnson Foundation, The Forrestal Center, P.O. Box 2316, Princeton, New Jersey 08540

Mann, Marion, 1973, Dean, College of Medicine, Howard University, 520 W Street, N.W., Washington, D.C. 20001

Mann, Robert W., 1971, Whitaker Professor in Biomedical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

Markert, Clement L., 1974, Professor of Biology, Department of Biology, Yale Univerversity, New Haven, Connecticut 06520

Marks, Paul A., 1972, Vice President for Health Sciences, Frode Jensen Professor of Medicine, Professor of Human Genetics and Development, Columbia University, College of Physicians and Surgeons, 630 West 168th Street, New York, New York 10032

Marston, Robert Q., 1973, President and Professor, The University of Florida, 216 Tigert Hall, Gainesville, Florida 32611

McAtee, Patricia R., 1975, Assistant Professor of Pediatrics, Department of Pediatrics, University of Colorado Medical Center, 4200 East Ninth Avenue, Denver, Colorado 80220

McCarty, Maclyn,* 1970, Vice President and Professor, The Rockefeller University, 1230 York Avenue, New York, New York 10021

McLachlan, Gordon, 1974, Secretary, The Nuffield Provincial Hospitals Trust, 3 Prince Albert Road, London, NW1, 7SP, England

McMachon, John Alexander, 1974, President, American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611

McNerney, Walter J., 1971, President, Blue Cross Association, 840 North Lake Shore Drive, Chicago, Illinois 60611

Mechanic, David, 1971, John Bascom Professor of Sociology, 8143 Social Science Building, University of Wisconsin, Madison, Wisconsin 53706

Meister, Alton, 1975, Professor, Cornell University Medical College, 1300 York Avenue, New York, New York 10021

Mellinkoff, Sherman M., 1974, Dean and Professor of Medicine, Dean's Office, University of California at Los Angeles School of Medicine, Los Angeles, California 90024

Menninger, W. Walter, 1972, Clinical Director, Topeka State Hospital, Staff Psychiatrist, The Menninger Foundation, P.O. Box 829, Topeka, Kansas 66601

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Merton, Robert K., 1973, University Professor, 415 Fayerweather Hall, Columbia University, New York, New York 10027

Meselson, Matthew S., 1974, Professor of Biology, The Biological Laboratories, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138

Michael, Max Jr., 1971, Assistant Dean, Jacksonville Hospitals Educational Program, 655 West Eight Street, Jacksonville, Florida 32209

Miller, Morton D., 1972, Vice President of the Board, The Equitable Life Assurance Society of the United States, 1285 Avenue of the Americas, New York, New York 10019

Mills, George H., 1971, Medical Director, The Kamehameha Schools, Bernice Pauahi Bishop Estate, Kapalama Heights, Honolulu, Hawaii 96817

Morris, Alvin L., 1971, Executive Director, Association for Academic Health Centers, Suite 302, 1625 Massachusetts Avenue, N.W., Washington, D.C. 20036

Morrison, Milnor B. Jr., 1971, 24 Smith Street, Pawling, New York 12564

Moses, Lincoln E., 1975, Professor of Statistics, Department of Community and Preventive Medicine, Stanford University School of Medicine, Stanford, California 94305

Mosteller, Frederick, 1971, Professor of Mathematical Statistics, Department of Statistics, Science Center, Sixth Floor, One Oxford Street, Harvard University, Cambridge, Massachusetts 02138

Motulsky, Arno G., 1974, Professor of Medicine and Genetics, Director, Center for Inherited Diseases, Division of Medical Genetics, RG-20, University of Washington School of Medicine, Seattle, Washington 98195

Mountcastle, Vernon B., 1975, Professor of Physiology, Director, Department of Physiology, Johns Hopkins University, School of Medicine, 725 North Wolfe Street, Baltimore, Maryland 21205

Murphy, Franklin D., 1975, Chairman of the Board, Times-Mirror Corporation, Times-Mirror Square, Los Angeles, California 90053

Murray, Robert F. Jr., 1975, Professor, Pediatrics and Medicine, Chief, Division of Medical Genetics, College of Medicine, Howard University, 520 W Street, N.W., Washington, D.C. 20001

Mushkin, Selma J., 1974, Director, Public Services Laboratory, Georgetown University, 3600 M Street, N.W., Washington, D.C. 20007

Neel, James V., 1972, Chairman and Lee R. Dice University Professor of Human Genetics, Department of Human Genetics, The University of Michigan Medical School, 1137 East Catherine Street, Ann Arbor, Michigan 48104

Nelson, Alan R., 1975, Practicing Internist, 2000 South Ninth East, Salt Lake City, Utah 84105

Nelson, Russell A., 1972, President Emeritus, The Johns Hopkins Hospital, 601 North Broadway, Baltimore, Maryland 21205

Newton, Quigg, 1972, Vice President of the Board, The Commonwealth Fund, Harkness House, One East Seventy-fifth Street, New York, New York 10021

Nirenberg, Marshall, 1971, Chief, Laboratory of Biochemical Genetics, National Heart and Lung Institute, National Institutes of Health, Bethesda, Maryland 20014

Old, Lloyd J., 1974, Vice President and Associate Director, Sloan-Kettering Institute for Cancer Research, 410 East 68th Street, New York, New York 10021

Pake, George, E., 1971, Vice President, Xerox Corporation, Manager, Palo Alto Research Center, Xerox Corporation, Palo Alto Research Center, 3333 Coyote Hill Road, Palo Alto, California 94304

Palade, George E., 1974, Sterling Professor of Cell Biology, Section of Cell Biology, School of Medicine, Yale University, 333 Cedar Street, New Haven, Connecticut 06510

Pardee, Arthur B., 1974, Professor of Pharmacology, Sidney Farber Cancer Center, 35 Binney Street, Boston, Massachusetts 02115

Pellegrino, Edmund D., 1972, Chairman of the Board of Directors, Yale-New Haven Medical Center, Professor of Medicine, Yale University School of Medicine, 789 Howard Avenue, New Haven, Connecticut 06504

Perrin, Edward B., 1974, Professor, Department of Health Services, School of Public Health, University of Washington, Research Scientist, Health Care Study Center, Battelle—Human Affairs Research Centers, 4000 N.E. 41st Street, Seattle, Washington 98105

Perry, J. Warren, 1973, Dean and Professor, School of Health Related Professions, State University of New York at Buffalo, 19 Diefendorf Annex, Buffalo, New York 14214

Petersdorf, Robert G., 1973, Professor and Chairman, Department of Medicine, University of Washington School of Medicine, Department of Medicine RG–20, Seattle, Washington 98195

Pettengill, Daniel W., 1974, Vice President, Group Division, Aetna Life and Casualty, 151 Farmington Avenue, Hartford, Connecticut 06115

Piel, Gerard, 1971, Publisher, The Scientific American, 415 Madison Avenue, New York, New York 10017

Pierce, Chester M., 1971, Professor of Education and Psychiatry, Harvard University, Nichols House-Appian Way, Cambridge, Massachusetts 02138

Price, James G., 1973, Practitioner of Medicine, 700 Turner Street, Brush, Colorado 80723

Puck, Theodore T., 1974, Professor of Biophysics and Genetics, University of Colorado Medical Center, Director, Eleanor Roosevelt Institute for Cancer Research, 4200 East Ninth Avenue, Denver, Colorado 80220

Rahn, Hermann, 1971, Professor of Physiology, Department of Physiology, Sherman Hall, State University of New York School of Medicine, Buffalo, New York 14214

Rammelkamp, Charles H. Jr., 1971, Professor of Medicine, Case Western Reserve University, Director, Department of Medicine, Cleveland Metropolitan General Hospital, 3395 Scranton Road, Cleveland, Ohio 44109

Ramsey, Paul, 1972, Professor of Religion, Princeton University, 613 Seventy Nine Hall, Princeton, New Jersey 08540

Ranney, Helen M., 1973, Professor and Chairman, Department of Medicine, School of Medicine, University of California-San Diego, University Hospital, 225 West Dickinson Street, San Diego, California 92103

Redlich, F. C., 1974, Professor of Psychiatry, School of Medicine, Behavioral Sciences Study Center, Yale University, 333 Cedar Street, New Haven, Connecticut 06510

Reswick, James B., 1972, Professor of Biomedical Engineering and Community Medicine, University of Southern California, Director, Rehabilitation Engineering Center, Rancho Los Amigos Hospital—County of Los Angeles, 760 Imperial Highway, Downey, California 90242

Rice, Dorothy P., 1972, Director, National Center for Health Statistics, Health Resources Administration, PHS, Department of Health, Education, and Welfare, 5600 Fishers Lane, Rockville, Maryland 20852

Richmond, Julius B., 1971, Professor of Child Psychiatry and Human Development, Professor of Preventive and Social Medicine in the Faculty of Public Health and the Faculty of Medicine, Harvard Medical School, Director, Judge Baker Guidance Center, Psychiatrist in Chief, Children's Hospital Medical Center, 295 Longwood Avenue, Boston, Massachusetts 02115

Riecken, Henry W.,* 1970, Professor of Behavioral Sciences, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania 19104

Robbins, Frederick C., 1973, Dean, School of Medicine, Professor of Pediatrics and Community Health, Case Western Reserve University, School of Medicine, 2119 Abington Road, Cleveland, Ohio 44106

Roberts, Doris E., 1973, Public Health Consultant, 6111 Kennedy Drive, Chevy Chase, Maryland 20015

Roemer, Milton I., 1974, Professor of Health Service Administration, University of California at Los Angeles School of Public Health, 405 Hilgard Avenue, Los Angeles, California 90024

Rogers, David E., 1971, President, The Robert Wood Johnson Foundation, The Forrestal Center, P.O. Box 2316, Princeton, New Jersey 08540

Rosenblith, Walter A.,* 1970, Provost and Institute Professor, Massachusetts Institute of Technology, Room 3/240, Cambridge, Massachusetts 02139

Roy, William R., 1973, Director of Medical Education and Professional Services, St. Francis Hospital, 1700 West Seventh Street, Topeka, Kansas 66606

Ryan, Kenneth J., 1971, Chief of Staff, Boston Hospital for Women, 221 Longwood Avenue, Boston, Massachusetts 02115

Sabiston, David C. Jr., 1971, Professor and Chairman, Department of Surgery, Duke University Medical Center, Durham, North Carolina 27710

Saward, Ernest,* 1970, Associate Dean, Extramural Affairs, University of Rochester, School of Medicine and Dentistry, 260 Crittenden Boulevard, Rochester, New York 14620

Schlotfeldt, Rozella M., 1971, Professor of Nursing, Frances Payne Bolton School of Nursing, Case Western Reserve University, 2121 Abington Road, Cleveland, Ohio 44106

Schoen, Max H., 1974, Associate Dean for Clinical Affairs and Professor of Dental Health Services, State University of New York at Stony Brook, School of Dental Medicine, Stony Brook, New York 11794

Schorr, Lisbeth Bamberger, 1973, Consultant, Children's Defense Fund, 1520 New Hampshire Avenue, N.W., Washington, D.C. 20036

Schultz, Charles L., 1973, Senior Fellow, Brookings Institution, 1775 Massachusetts Avenue, N.W., Washington, D.C. 20036

Schwartz, William B., 1971, Endicott Professor and Chairman of the Department of Medicine, University Professor, Department of Medicine, Tufts University School of Medicine, 171 Harrison Avenue, Boston, Massachusetts 02111

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Seldin, Donald W., 1974, William Buchanan Professor and Chairman, Department of Nutrition and Food Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Seldin, Donald W., 1974, William Buchanan, Professor and Chairman, Department of Internal Medicine, The University of Texas-Southwestern Medical School, 4323 Harry Hines Boulevard, Dallas, Texas 75235

Shannon, Iris R., 1975, Chairperson, Community Health Nursing, Rush College of Nursing and Allied Health Sciences, Rush Presbyterian-St. Luke's Medical Center, 1753 West Congress Parkway, Chicago, Illinois 60612

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Shapiro, Sam, 1974, Director, Health Services Research and Development Center, Professor, Health Care Organization, The Johns Hopkins Medical Institutions, 624 North Broadway, Baltimore, Maryland 21205

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Sheps, Cecil George, 1973, Vice Chancellor, Health Sciences, Professor of Social Medicine, University of North Carolina at Chapel Hill, 104 South Building, Chapel Hill, North Carolina 27514

Shires, G. Tom, 1975, Professor and Chairman, Department of Surgery, Cornell University Medical College, 1300 York Avenue, New York, New York 10021

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Sinsheimer, Robert L., 1974, Professor and Chairman, Division of Biology, California Institute of Technology, Pasadena, California 91109

Smith, Lloyd H. Jr., 1973, Professor and Chairman, Department of Medicine, University of California-San Francisco Medical Center, Third and Parnassus, San Francisco, California 94143

Smith, Richard A., 1972, Professor of Community Health, Director, Health Manpower Development Staff, School of Medicine, University of Hawaii, 1960 East-West Road, Honolulu, Hawaii 96822

Solomon, David H., 1975, Professor and Chairman, Department of Medicine, UCLA School of Medicine, Los Angeles, California 90024

Somers, Anne R., 1973, Associate Professor, Departments of Community Medicine and Family Medicine, College of Medicine and Dentistry of New Jersey-Rutgers Medical School, Research Associate, Industrial Relations Section, Princeton University, 31 Scott Lane, Princeton, New Jersey 08540

Somers, Herman M., 1972, Professor of Politics and Public Affairs, Woodrow Wilson School of Public and International Affairs, Princeton University, Princeton, New Jersey 08540

Spellman, Mitchell W., 1972, Executive Dean, Charles R. Drew Postgraduate Medical School, 1621 East 120th Street, Los Angeles, California 90059

Spencer, William A., 1971, Professor and Chairman, Fleming Department of Rehabilitation, Baylor College of Medicine, Director, Texas Institute for Rehabilitation and Research, 1333 Moursund Avenue, Houston, Texas 77025

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Stark, Nathan J., 1973, Vice Chancellor, Schools of the Health Professions, University of Pittsburgh, 12th Floor, Scaife Hall—Terrace and DeSoto Streets, Pittsburgh, Pennsylvania 15261

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Straus, Robert, 1975, Professor and Chairman, Department of Behavioral Science, College of Medicine, University of Kentucky, Lexington, Kentucky 40506

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Thomas, Andrew L., 1973, President, Institute for Health Resources Development, Suite 700, 1020 South Wabash Avenue, Chicago, Illinois 60605

Thomas, Lewis, 1971, President and Chief Executive Officer, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, New York 10021

Tornyay, Rheba de, 1972, Dean and Professor, School of Nursing, University of Washington, School of Nursing, University of Washington, Seattle, Washington 98195

Tosteson, Daniel C., 1972, Dean of the Biological Sciences Division and the Pritzker School of Medicine, The Lowell T. Coggeshall Professor in Medical Sciences, University of Chicago, 950 East 59th Street, Chicago, Illinois 60637

Turner, John B., 1971, William Keenan Professor, School of Social Work, 223 East Franklin Street, Chapel Hill, North Carolina 27514

Vagelos, P. Roy, 1974, Senior Vice President, Merck, Sharp and Dohme Research Laboratories, Division of Merck & Co., Inc., Rahway, New Jersey 07065

Volker, Joseph F., 1971, President, University of Alabama in Birmingham, University Station, Birmingham, Alabama 35294

Ward, L. Emmerson, 1974, Chairman, Board of Governors, Mayo Clinic, 200 First Street, S.W., Rochester, Minnesota 55901

Ward, Paul D., 1973, Executive Director, California Committee on Regional Medical Programs, 7700 Edgewater Drive—Suite 520, Oakland, California 94621

Warren, James V., 1971, Professor and Chairman, Department of Medicine, The Ohio State University Hospitals, 410 West 10th Avenue, Columbus, Ohio 43210

Watson, C. Gordon, 1975, Executive Director, American Dental Association, 211 East Chicago Avenue, Chicago, Illinois 60611

Watts, Charles D., 1974, Assistant Director, Lincoln Community Health Center, 510 Simmons Street, Durham, North Carolina 27701

Watts, Malcolm S. M., 1973, Practitioner of Medicine, Associate Dean, Director, Extended Programs in Medical Education, School of Medicine, University of California at San Francisco, San Francisco, California 94143

Weller, Thomas H.,* 1970, Richard Pearson Strong Professor and Chairman, Department of Tropical Public Health, 665 Huntington Avenue, Boston, Massachusetts 02115

White, Kerr L., 1973, Professor of Health Care Organization, The Johns Hopkins University, School of Hygiene and Public Health, 615 North Wolfe Street, Baltimore, Maryland 21205

Wilbur, Richard S., 1971, Senior Vice President, Baxter Laboratories, Deerfield, Illinois 60015

Wildgen, J. Jerome, 1973, Practitioner of Medicine, Sunset Boulevard and Nevada Street, Kalispell, Montana 59901

Williams, Bryan,* 1970, Associate Dean for Student Affairs, University of Texas Southwestern Medical School, 5323 Harry Hines Boulevard, Dallas, Texas 75235

Williams, Carroll M., 1974, Benjamin Bussey Professor of Biology, The Biological Laboratories, Harvard University, 16 Divinity Avenue, Cambridge, Massachusetts 02138

Wilson, Marjorie P., 1974, Director, Department of Institutional Development, Association of American Medical Colleges, One Dupont Circle, Suite 200, Washington, D.C. 20036

Wise, Harold, 1972, Director, Internship and Residency, Program in Social Medicine, Department of Social Medicine, Montefiore Hospital and Medical Center, 111 East 210th Street, Bronx, New York 10467

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Woods, Geraldine P., 1974, Special Consultant, National Institute of General Medical Sciences, National Institutes of Health, 12065 Rose Marie Lane, Los Angeles, California 90049

Wyngaarden, James B., 1973, Professor and Chairman, Department of Medicine, Duke University Medical Center, Durham, North Carolina 22710

Yancey, Asa G., 1973, Medical Director, Grady Memorial Hospital, Associate Dean, Emory University School of Medicine, Associate Professor of Surgery, Emory University School of Medicine, Grady Memorial Hospital, 80 Butler Street, S.E., Atlanta, Georgia 30303

Yarmolinsky, Adam,* 1970, Ralph Waldo Emerson Professor of the University, University of Massachusetts, One Washington Mall, Boston, Massachusetts 02108

Yerby, Alonzo S.,* 1970, Professor of Health Services Administration, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115

Zamencik, Paul C., 1974, Director, The John Collins Warren Laboratories of the Huntington Memorial Hospital, Massachusetts General Hospital, Boston, Massachusetts 02114

Zuidema, George D., 1971, Warfield M. Firor Professor and Director, Section of Surgical Sciences, Surgeon in Chief, Department of Surgery, Blalock 634, The Johns Hopkins Hospital, 601 North Broadway, Baltimore, Maryland 21205

SENIOR MEMBERS

Beeson, Paul B., 1970, Seattle Veterans Administration Hospital, 4435 Beacon Avenue South, Seattle, Washington 98108

Brodie, Bernard B., 1971, Visiting Professor, Hershey School of Medicine, Senior Consultant, Hoffmann-LaRoche, 252 Cherry Lane, Palm Beach, Florida 34480

Child, Charles G., III, 1970, Professor of Surgery, University of Michigan Medical School, 1405 East Ann Street, Ann Arbor, Michigan 48104

Conn, Jermone W., 1971, L. H. Newburgh University Professor of Internal Medicine, Emeritus, Distinguished Physician, United States Veterans Administration, Veterans Administration Hospital, 2215 Fuller Road, Ann Arbor, Michigan 48105

Freund, Paul A., 1971, University Professor, Harvard University Law School, Cambridge, Massachusetts 02138

Leone, Lucile P., 1971, 125 Cambon Drive, San Francisco, California 94132

McDermott, Walsh, 1970, Special Advisor to the President, The Robert Wood Johnson Foundation, The Forrestal Center, P.O. Box 2316, Princeton, New Jersey 08540

Nabrit, Samuel M., 1971, Executive Director, The Southern Fellowships Fund, 795 Peachtree Street, N.W., Atlanta, Georgia 30308

Page, Irvine H., 1971, Director Emeritus, Research Division, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, Ohio 44106

Shannon, James A., 1971, Professor of Biomedical Sciences, The Rockefeller University (Retired), Visiting Scholar, National Library of Medicine, National Institutes of Health, Bethesda, Maryland 20014

Stead, Eugene A., Jr., 1970, Florence McAlister Professor of Medicine, Duke University, Box 3910 Duke Medical Center, Durham, North Carolina 27710

Wilbur, Dwight Locke, 1971, Clinical Professor of Medicine Emeritus, Stanford University School of Medicine, 655 Sutter Street, Suite 602, San Francisco, California 94102

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*Denotes Charter Members.

STANDING COMMITTEES OF THE INSTITUTE

June 30, 1976

FINANCE COMMITTEE

Chaiman, Nathan J. Stark; *Members*: Ivan L. Bennett, Jr.,[1] Lloyd C. Elam, Martin S. Feldstein, Walter J. McNerney, Alvin L. Morris, Daniel W. Pettengill, Gerard Piel.[2]

MEMBERSHIP COMITTEE

Chairman, Kerr L. White;[2] *Members*: Odin W. Anderson, Kathleen G. Andreoli, William G. Anlyan, Lewis W. Butler, Seymour S. Cohen, Anna B. Coles, F. William Dowda,[2] Donald J. Galagan, James W. Haviland, Margaret E. Mahoney, David Mechanic, Sherman M. Mellinkoff, Selma J. Mushkin, Helen M. Ranney, Carroll M. Williams, Asa G. Yancey.[2]

PROGRAM COMMITTEE

Chairman, Alain C. Enthoven;[2] *Members*: Myrtle K. Aydelotte,[2] Wilbur J. Cohen, Albert Dorfman,[2] Paul M. Ellwood, John R. Evans, Carl W. Gottschalk, Robert C. Long, C. Frederick Mosteller,[2] William R. Roy, Eleanor B. Sheldon, Mitchell W. Spellman.

PRESIDENTS OF THE INSTITUTE OF MEDICINE

John R. Hogness, M.D	August 1971–April 1974
Donald S. Fredrickson, M.D	July 1974–July 1975
David A. Hamburg, M.D	November 1975–

Roger J. Bulger, as Executive Officer of the Institute, assumed the major duties of president between the time of Dr. Fredrickson's departure and the assumption of the office by David A. Hamburg in November, 1975. Dr. Bulger resigned from the Institute in January, 1976, to become chancellor of the University of Massachusetts at Worcester and dean of the medical school.

Dr. Hamburg was inaugurated in ceremonies arranged during the 1975 Annual Meeting of the Institute, on November 6. He assumed the responsibilities of president full time on June 1, 1976, following completion of his academic commitments at Stanford University where he held the Reed-Hodgson Professorship of Human Biology and was simultaneously a member of the faculty in psychiatry.

DECEASED MEMBERS—INSTITUTE OF MEDICINE

Wood, W. Barry Jr	March 9, 1971 (Charter Member)
McLeod, Colin	February 12, 1972
Moore, Carl V	August 13, 1972
Logan, Arthur C	November 25, 1973
Welt, Louis G	January 13, 1974

RESIGNED FROM INSTITUTE OF MEDICINE

Hewlett, William R	November 22, 1972
Weed Lawrence L	September 19, 1973

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[1] Resigned on 2/17/76.
[2] Term expires on 6/30/76.

APPENDIX IV

NATIONAL RESEARCH COUNCIL

EXECUTIVE ORDER ISSUED BY THE PRESIDENT OF THE UNITED STATES, MAY 10, 1956

Executive Order No. 2859 of May 11, 1918, relating to the National Research Council is hereby amended to read as follows:

"NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES

"Whereas the National Research Council (hereinafter referred to as the Council) was organized in 1916 at the request of the President by the National Academy of Sciences, under its congressional charter, as a measure of national preparedness; and

"Whereas in recognition of the work accomplished by the National Academy of Sciences through the Council in organizing research, in furthering science, and in securing cooperation of government and non-government agencies in the solution of their problems, the Council has been perpetuated by the Academy as requested by the President in Executive Order No. 2859 of May 11, 1918; and

"Whereas the effective prosecution of the Council's work requires the close cooperation of the scientific and technical branches of the Government, both military and civil, and makes representation of the Government on the Council desirable:

"Now, Therefore, by virtue of the authority vested in me as President of the United States, it is ordered as follows:

"1. The functions of the Council shall be as follows:

"(*a*) In general, to stimulate research in the mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

"(*b*) To survey the broad possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with such projects.

"(*c*) To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

"(*d*) To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the Department of Defense and of the civil branches of the Government.

"(*e*) To direct the attention of scientific and technical investigators to the importance of military and industrial problems in connection with national defense, and to aid in the solution of these problems by organizing specific researches.

"(*f*) To gather and collate scientific and technical information, at home and abroad, in cooperation with government and other agencies, and to render such information available to duly accredited persons.

"2. The Government shall be represented on the Council by members who are officers or employees of specified departments and agencies of the executive branch of the Government. The National Academy of Sciences shall specify, from time to time, the departments and agencies from which Government members shall be designated, and shall determine, from time to time, the number of Government members who shall be designated from each such department and agency. The head of each such specified department or agency shall designate the officers and employees from his department or agency, in such numbers as the National Academy of Sciences shall determine, who shall be members of the Council, but shall designate only those persons who are acceptable to the Academy."

This order shall not be construed as terminating the tenure of any person who has heretofore been designated as a member of the Council.

(Signed) DWIGHT D. EISENHOWER.

THE WHITE HOUSE, *May 10, 1956.*

(No. 10668)

ARTICLES OF ORGANIZATION, NATIONAL RESEARCH COUNCIL

PREAMBLE

The Council of the National Academy of Sciences, under the authority conferred upon the Academy by its charter enacted by Congress and approved by President Lincoln on March 3, 1863, and pursuant to the request expressed in Executive Order No. 2859 of May 11, 1918, as amended by Executive Order No. 10668 of May 10, 1956, and under the authority conferred upon the Council by action of the Academy, April 29, 1919, hereby adopts the following amended Articles of Organization for the National Research Council,* effective October 30, 1974, superseding the previously amended Articles of Organization dated July 1, 1946.

ARTICLE I—PURPOSE

It shall be the purpose of the National Research Council to promote the increase of knowledge in the behavioral and social, biological, engineering, mathematical, medical, and physical sciences, and to foster the application of these sciences for the public welfare. To this end, and under policies established by the National Academy of Sciences in consultation with the National Academy of Engineering and the Institute of Medicine, which have been organized under the corporate charter of the National Academy of Sciences, the National Research Council shall, in other than exceptional circumstances, be the operating agency of the National Academy of Sciences and of the National Academy of Engineering for service in the national interest and for furnishing scientific and technical advice to governmental and other organizations.

ARTICLE II—GOVERNING BOARD

Section 1.(a)—The authority for the governance and oversight of the National Research Council shall be vested in a Governing Board.

The Governing Board shall consist of (1) the President and Vice President of the National Academy of Sciences, and five other members of the Council of the National Academy of Sciences, designated by that Council; (2) the President and Vice President of the National Academy of Engineering and two other members of the Council of the National Academy of Engineering, designated by that Council; and (3) the President of the Institute of Medicine and one other member of the Council of the Institute of Medicine, designated by that Council.

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*These Articles are consonant with the Statement of Principles underlying joint operation of the National Research Council, dated October 24, 1973, which was approved by the National Academy of Sciences and by the National Academy of Engineering and comprises in part the legislative history of these Articles The relationships described for the Institute of Medicine were approved by the Council of that Institute.

(b) The President of the National Academy of Sciences or, in his extended absence, the Acting President of the National Academy of Sciences, shall serve as Chairman of the Governing Board and its Executive Committee; the President of the National Academy of Engineering shall serve as Vice Chairman of the Governing Board.

(c) The President, or Acting President, of the National Academy of Sciences shall serve as Chairman of the National Research Council; the President of the National Academy of Engineering shall serve as Vice Chairman of the National Research Council.

Section 2.(a)—The Board shall meet at the call of the Chairman as often as its business requires, but no less than four times annually; a quorum shall consist of not fewer than seven members of the Board, four of whom shall be representatives from the National Academy of Sciences, two representatives from the National Academy of Engineering, plus one other member of the Governing Board. Actions with respect to the programs of the Institute of Medicine shall be taken only in the presence of at least one representative from the Institute of Medicine. In the absence of both the Chairman and Vice Chairman, those present shall elect a Chairman-pro tem from among their number.

(b) Meetings of the Board shall be conducted according to Robert's Rules of Order. All actions of the Governing Board shall require at the minimum a majority of those present and voting; however, if an action is opposed by all the representatives of one of the Academies who are present, and those members so request, the question shall then be deferred for reconsideration and disposition at the next meeting of the Governing Board.

Section 3.—There shall be an Executive Committee of the Governing Board consisting of the President of the National Academy of Sciences, who shall serve as chairman, the President of the National Academy of Engineering and the President of the Institute of Medicine.

ARTICLE III—ASSEMBLIES AND COMMISSIONS

Section 1.—The National Research Council shall be organized into two types of major constituent units, designated as Assemblies and Commissions, to contribute to the advancement of the branches of sciences and technology and to bring to bear upon the nation's major problems the knowledge, analytical tools, and methods of the sciences and engineering. Assemblies shall be concerned with furthering the advancement of their component disciplines, and with the general furtherance of science and engineering as components of the intellectual resources of the nation, and with their contribution to national life. Commissions, as multidisciplinary bodies, shall be concerned principally with those problems of the nation and society that require the application of a broad range of interdisciplinary knowledge in scientific, engineering and other fields. These Assemblies and Commissions, together with the Governing Board, shall comprise the National Research Council.

Section 2.(a)—The purposes, functions, and governance of the Assemblies shall be in accord with the respective Terms of Reference of the individual Assemblies as approved by the Council of the National Academy of Sciences or the Council of the National Academy of Engineering. The initial Assemblies shall be those of (1) Behavorial and Social Sciences, (2) Engineering, (3) Mathematical and Physical Sciences, and (4) Life Sciences. Additional Assemblies may be established by the Governing Board when so recommended by the Council of the National Academy of Sciences, of the National Academy of Engineering, or of the Institute of Medicine.

(b) Each Assembly shall be representative of the several branches of science and technology reflected in its Terms of Reference, and shall consist of a chairman, an executive committee, and such members as may be provided in its Terms of Reference. Appointments to these offices in each Assembly, except that of Engineering, shall be made by the Chairman of the National Research Council upon nomination by the Vice Chairman of the National Research Council with the approval of the Council of the National Academy of Engineering.

(c) The terms of office of the chairmen and members of the Executive Committees of the Assemblies shall not exceed three years and such appointments shall be limited to two consecutive terms.

(d) Responsibility for the conduct of the affairs of each Assembly shall be lodged in its chairman and Executive Committee. The Executive Committee shall meet no less than three times annually on the call of the chairman.

(e) Each Assembly shall provide for liaison with appropriate scientific or engineering societies, professional associations and federal agencies.

(f) Within authorizations granted by the Governing Board, each Assembly may establish such standing boards or committees as it finds to be necessary and appropriate.

(g) Except as provided herein, Assemblies shall be subject to the powers of the Governing Board of the National Research Council as set forth in Article IV.

Section 3.(a)—The Governing Board of the National Research Council shall establish the Commissions of the National Research Council, define their purposes and functions, and provide for their governance, organization, and authority. The initial Commissions shall be those on Human Resources, International Relations, Natural Resources, and Sociotechnical Systems.

(b) Each Commission shall consist of a chairman and other members, representative of diverse disciplines and institutions, in such numbers as may be indicated in their Terms of Reference as approved by the Governing Board of the National Research Council. Appointment to these offices shall be made by the Chairman of the National Research Council with the approval of the Governing Board.

(c) The terms of office of the chairman and members of a Commission shall not exceed three years, with eligibility for appointment limited to not more than two consecutive terms.

(d) The Commission shall meet at the call of the chairman but not less than three times annually.

(e) Each Commission shall provide for liaison with such societies, professional associations and federal agencies as may be appropriate.

ARTICLE IV—POWERS

Governing Board

Section 1.—The Governing Board shall have power to:

(a) authorize or terminate contracts on behalf of the Council of the National Academy of Sciences;

(b) approve an annual budget for the operation of the National Research Council for inclusion in the annual institutional budget to be approved by the Council of the National Academy of Sciences;

(c) approve appointments of such senior staff positions in the National Research Council as the Governing Board may determine to be necessary;

(d) modify the structure and organization of the National Research Council. Major changes should be made after consultation with the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine;

(e) determine policy for the National Research Council;

(f) review the program of the National Research Council, and evaluate its effectiveness with respect to national needs;

(g) take such other actions as may be necessary to conduct the affairs of the National Research Council, consistent with the act of incorporation of the National Academy of Sciences, the NAS Constitution, and these Articles of Organization.

Executive Committee

Section 2.—The Executive Committee of the Governing Board shall have authority, on behalf of the Governing Board, to approve by unanimous vote, proposals for grants and contracts in accordance with policies established by the Governing Board.

Section 3.—The Executive Committee shall meet at the call of the Chairman for the above purpose, to resolve questions of interpretation or implementation of policy, and to transact such other business as may properly come before it. All formal actions shall be reported at the next following meeting of the Governing Board.

Chairman, National Research Council

Section 4.—As chief executive of the National Research Council, the Chairman:

(a) shall sign contracts resulting from proposals authorized by action of the Governing Board; or, with his approval, such contracts may be signed by his designee;

(b) shall be responsible for the report review process and, to that end, shall provide for a Report Review Committee, with members and review panels drawn from the membership of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine; and shall appoint the chairman and members of the Report Review Committee;

(c) shall be responsible for management and administration of the National Research Council, including the power to approve all appointments, and for those supporting services necessary to its effective operation;

(d) shall consult with the President of the National Academy of Engineering and the President of the Institute of Medicine on issues centered in engineering and medicine, respectively, relating to personnel and programs and on these matters seek concurrence of the appropriate individual before decisions are reached.

Section 5.—The Vice Chairman of the National Research Council shall serve as deputy to the Chairman and shall assist the Chairman in carrying out his responsibilities as chief executive of the National Research Council.

Chairmen of Assemblies and Commissions

Section 6.—The chairman of each Assembly and Commission shall:

(a) in accord with the Terms of Reference of the Assemblies and Commissions recommend for approval by the Chairman of the National Research Council the members of Boards, Committees, and Subcommittees of the respective Assembly or Commission; and upon approval by the Chairman of the National Research Council, shall be empowered to make such appointments;

(b) be responsible to the Chairman of the National Research Council and through him to the Governing Board for the scientific oversight and conduct of all projects and programs of the Assembly or Commission, and for such other matters as may be assigned by the Governing Board;

(c) normally participate in all regular meetings, except for executive sessions, of the Governing Board, but shall not vote;

(d) approve the appointment of the executive director of the respective Assembly or Commission;

(e) be responsible for the preparation of an annual program plan, of an annual authorization request, and of annual substantive and administrative reports of the Assembly or Commission.

ARTICLE V—RELATIONS WITH ACADEMIES AND INSTITUTE

Section 1.—The Presidents of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, as chairmen of their respective Councils, shall be responsible for forwarding to the attention and consideration of the Governing Board any proposals, views, or actions of their Councils germane to the program and operations of the National Research Council. They shall also inform the Governing Board of the intention to establish Academy or Institute committees to initiate program studies. They shall be responsible for reporting to their respective Councils any matter arising in the NRC which warrants attention by their Councils.

ARTICLE VI—ANNUAL REPORT

Section 1.—An annual report on the work of the National Research Council shall be presented by the Chairman to the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine; such report shall be suitable for inclusion in the annual report submitted by the National Academy of Sciences to the Congress of the United States.

ARTICLE VII—AMENDMENTS

Section 1.—These Articles of Organization may be amended by the Council of the National Academy of Sciences, after consultation with the Councils of the National Academy of Engineering and of the Institute of Medicine.

APPENDIX V

Report of the Treasurer

Treasurer's Statement

To the Council of the National Academy of Sciences:

The financial statements and schedules that follow reflect the financial condition of the National Academy of Sciences, including the National Academy of Engineering, the Institute of Medicine, and the National Research Council, as of June 30, 1976, and the results of operations during the fiscal year ended on that date.

INVESTMENTS

Consolidated Fund–Schedules 1, 1-A, and 1-B

The investments of the Consolidated Fund of the Corporation are summarized by classes of investment as follows:

	JUNE 30, 1976			
	BOOK VALUE (COST)	MARKET VALUE	PERCENT*	INCOME
Bonds and Notes	$ 3,819,807	$ 3,813,111	17.84	$246,224
Common Stocks	14,587,612	16,580,373	77.60	384,039
Cash and Cash Equivalents	975,443	975,443	4.56	77,170
Total	$19,382,862	$21,368,927	100.00	$707,433

*Of market value.

During 1975–1976 the distribution of holdings by major classes of investment changed from the levels of a year ago. The percentage of investments in fixed-income securities increased 7.10%, while the percentage in common stocks decreased 5.42%. Cash and cash equivalents on hand decreased slightly compared to last year.

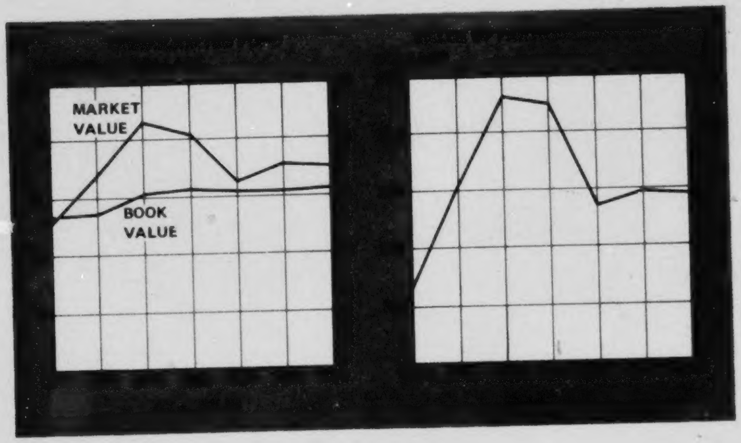
The book value of investments at June 30, 1976 was $926,845 greater than at the end of the previous year. The principal items contributing to this change were receipts of $35,952 for the Kobelt Fund, $7,997 for the Eckart Fund, $20,000 for the Carnegie Fund, $189,314 for the General Endowment Fund, and decreases of $60,000 from the Day Fund, $2,000 from the Gibbs Fund, $92,980 from the Staff Retirement Fund, $8,979 from the Slipher Fund, plus a gain of $837,541 on sale of securities.

The market value of the investments owned was 110.25% of cost on June 30, 1976, compared with 115.37% at the end of the previous fiscal year. During the past year, the income on the average market value of all investments was at the rate of 3.33%, an increase from the rate of 2.79% for the previous year.

The funds participating in the Consolidated Fund are summarized in Schedule 4.

Pooled investments in the Consolidated Fund are administered like an open-end investment trust: Equities of the funds in the pool are expressed in terms of participating capital units. Each participating capital unit was assigned a value of $100 as of July 1, 1953; the value had decreased to $237.65 by June 30, 1976, from the value of $239.38 or 0.7%, as of the end of the preceding fiscal year.

During the year the Finance Committee decided to divide the management of the Consolidated Fund portfolio equally between two Investment Counsellors. Accordingly, Weiss, Peck & Greer of New York and American Security & Trust Company of Washington were selected. American Security & Trust Company acts as custodian of securities for both Investment Counsellors.



Termination Allowance Trust Fund–Schedules 2 and 2A

In accordance with the labor laws of the Japanese Government, the Academy was liable for termination compensation to Japanese nationals who were employed by the Atomic Bomb Casualty Commission (ABCC). As of April 1, 1975, the ABCC was succeeded by the Radiation Effects Research Foundation (RERF), a non-profit research institute incorporated under the laws of Japan. The termination liability of the Academy became fixed as of March 31, 1975. Future termination allowances earned after March 31, 1975 are the responsibility of RERF which is supported equally by the U.S. Government, through the Energy Research and Development Administration, and the Japanese Government.

In June 1972, the termination liability accrued to that date was funded by the U.S. Government and the fund was increased periodically as the liability increased. This arrangement ended March 31, 1975. The funds on hand continue to be managed by the Academy and will be paid as the employees who now work for the RERF terminate their employment. The Termination Allowance Fund is being transferred during the next fiscal year to the control and operation of RERF.

During the period of this report, the funds earned interest amounting to $321,690. The funds held in the Termination Allowance Trust Fund are summarized as follows:

	JUNE 30, 1976			
	BOOK VALUE (COST)	MARKET VALUE	PERCENT*	INCOME
Employee Loans Fund–Japan	$ 550,000	$ 550,000	8.72	$ 26,232
Cash, Cash Savings, and Receivables	476,098	476,098	7.55	30,866
Cash Equivalents	5,280,000	5,280,000	83.73	264,592
Total	$6,306,098	$6,306,098	100.00	$321,690

*Of market value.

Investment of Working Capital Funds–Schedule 3

Short-term investments of working capital funds totaled $6,793,739 at June 30, 1976. During the year, interest income of $403,156 was earned from this class of investments.

OPERATIONS

Exhibit B is a summary statement of income and expenses and changes in fund balances in the broad traditional classes of current funds, trust and endowment funds, and plant funds.

Activities conducted in response to requests of the United States Government are financed through cost reimbursement contracts. As expenses are incurred, bills are submitted to the Federal Government agencies for reimbursement. Income recognized is equal to the expenses incurred for those government-sponsored activities. On the other hand, activities supported by private, nonfederal agencies are usually financed by grants and agreements which provide for the funds to be paid to the Academy in lump sum or fixed incremental payments in advance of the expenses being incurred. These funds are available for expenditure on these projects during the current year and frequently also in subsequent years. Accordingly, the item of Deferred Income on the balance sheet of $2,666,816 represents those funds on hand at the close of the year which were available for later expenditure for specific activities under private grants, agreements, bequests, deferred rental income, and subscription sales. The amount received from private and nonfederal sources and used in the current year was $4,188,112.

The total operating expenses for the fiscal year amounted to $55,418,362. Of this amount, approximately $1,139,321, or 2.1%, was spent on activities designated as "classified" under the government security regulations. This is an increase from last year when $973,884, or 2%, was spent on such activities.

The operation of the Joseph Henry Building for the fiscal year resulted in a gain on operations of $26,381. Included in the costs of operation is an amount for the annual amortization costs of the improvements built into the building for use of both the commercial tenants and the Academy. The value of leasehold improvements remaining unamortized as of the end of the year was $505,458. The cost of the office space occupied by the Academy activities was $7.60 per square foot, including maintenance and utilities.

The following provide additional financial information on the operations during 1975–1976:

(a) In Table I below the sources of income used under contracts and grants for current purposes are summarized by agencies and organizations; and

(b) Table II below lists total current expenses by functional categories.

(c) Schedule 5 of this report reflects (1) expenditures from the current general funds in support of the two Academies, the Institute of Medicine, the National Research Council, other offices and services, and the physical plant; (2) expenditures from current restricted funds, the sources of which were agencies of the U.S. Government; and (3) expenditures from current restricted funds, the sources of which were private foundations, industrial concerns, state governments, and individuals. In (2) and (3) the major activities and principal sources of funds are indicated.

TABLE I

CURRENT FUNDS

Income by Source

U.S. GOVERNMENT AGENCIES (GRANTS AND CONTRACTS)

Department of Agriculture	$ 84,926
Department of Commerce	1,490,781
Department of Defense	
Department of the Air Force	747,514
Department of the Army	1,155,180
Department of the Navy	2,187,449
Department of Health, Education, and Welfare	5,035,776
Department of Housing and Urban Development	183,295
Department of the Interior	528,876
Department of Justice	296,266
Department of Labor	119,897
Department of State	1,297,889
Department of Transportation	5,314,104
Library of Congress	721
Executive Office of the President	299,898
Agency for International Development	756,168
Energy Research and Development Administration	6,095,893
Environmental Protection Agency	2,918,782
Federal Energy Administration	162,062
General Services Administration	118,482
National Aeronautics and Space Administration	5,508,601
National Science Foundation	8,222,951
U.S. Arms Control and Disarmament Agency	9,229
Veterans Administration	4,693,300
Total	$47,228,040

TABLE I
continued

PRIVATE AND NONFEDERAL SOURCES (GRANTS, CONTRACTS, AND CONTRIBUTIONS)

Income Applied to Current Fiscal Year

Alcoa Foundation	$ 20,000
American Academy of Arts and Sciences	14,932
American Bureau of Shipping	20,000
American Cancer Society	23,290
American Telephone & Telegraph Company	21,000
Amoco Foundation, Inc.	10,000
Association of American Railroads	50,000
Bechtel Foundation	11,000
Bethlehem Steel Corporation	20,000
Brazilian National Research Council	33,485
Chicago United	20,635
Commonwealth Fund	200,000
Arthur Vining Davis Foundation	15,000
E. I. DuPont de Nemours & Company	26,500
Exxon Corporation	31,000
Ford Foundation	197,540
Ford Motor Company	20,000
Foundation for Microbiology	15,000
General Electric Company	30,000
General Electric Foundation	20,000
General Motors Corporation	40,000
General Telephone and Electronics Foundation	10,000
Goodyear Tire and Rubber Company	20,000
W. R. Hewlett Foundation	100,000
Hoffman LaRoche, Inc.	30,000
IBM Corporation	32,000
Inter-Union Commission on Solar Terrestrial Physics Secretariat	17,000
The International Foundation	52,060
Robert Wood Johnson Foundation	519,289
Jones and Laughlin Steel Co.	10,000
The Henry J. Kaiser Family Foundation	50,000
Kaiser Foundation Hospital	25,000
Lilly Research Laboratories	20,300
Mallinckrodt Chemical Co.	10,500
McDonnell Douglas Corporation	21,000
R. K. Mellon Foundation	300,000

TABLE I
continued

Income Applied to Current Fiscal Year (continued)

Merck and Company, Inc.	$ 15,500
The Charles E. Merrill Trust	20,000
Mobil Oil Corporation	45,000
Monsanto Company	34,500
Pfizer, Inc.	16,000
Pharmaceutical Manufacturers Association Foundation, Inc.	17,325
RCA Corporation	20,000
Rockefeller Foundation	27,003
Russell Sage Foundation	75,000
G. D. Searle & Company	11,000
Alfred P. Sloan Foundation	15,000
Stauffer Chemical Co.	10,800
Sterling Drug, Inc.	20,000
Texaco, Inc.	10,000
Union Carbide Corporation	28,000
United States Steel Corporation	25,000
Various State Governments	1,310,000
Westinghouse Educational Foundation	20,300
Wyeth Laboratories	15,250
The Xerox Fund	20,000
Miscellaneous (less than $10,000 per donor)	375,903
Total	$4,188,112

TABLE II

ALL CURRENT FUNDS

Expenses by Functional Categories

General Funds–Administrative Costs	
Program Administration	$ 5,176,371
General Administration	6,518,383
Dissemination of Information and Publication Activities	1,749,706
Sub-total, Administrative Costs	13,444,460
Program Funds–Government and Private	
Advisory and Research Activities	32,821,855
Conferences and Symposia	601,011
Fellowships and Other Support of Scholars	8,551,036
Sub-total, Government and Private	41,973,902
Total Expenses	$55,418,362

Expenditures for all current purposes (excluding transactions of a capital nature in the Trust and Endowment Funds and in the Plant Funds) during the past ten years are represented in the chart on page 13.

TRUST FUNDS

During the year there were additions to the Trust and Endowment Funds as follows:

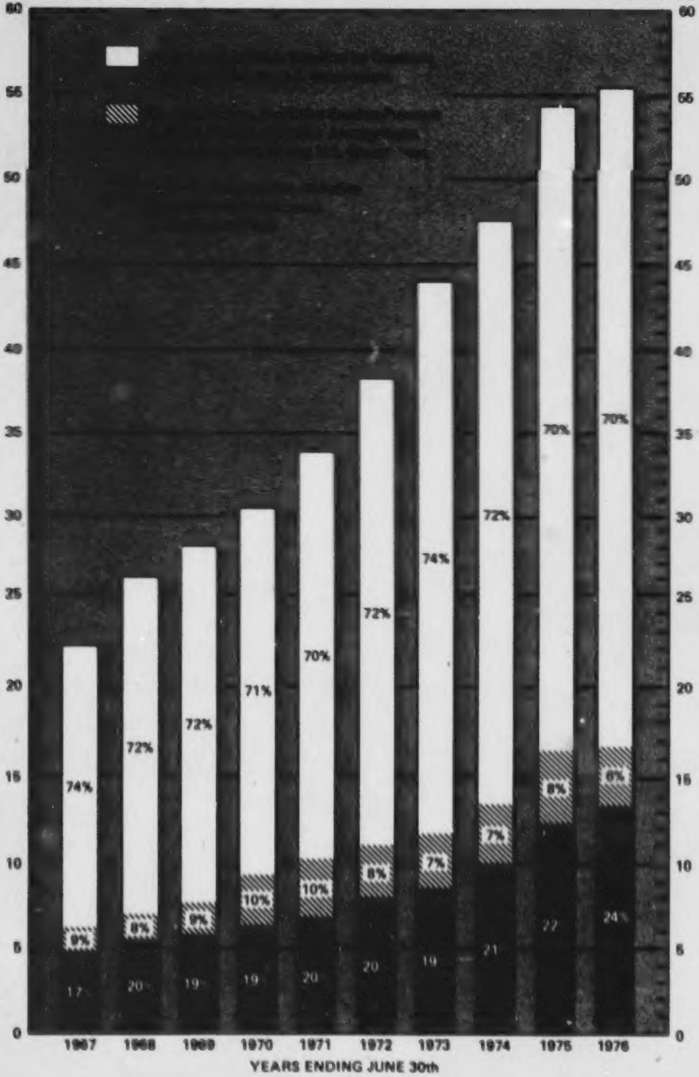
a. A bequest of $7,997 from the estate of Carl Eckart to be used for general purposes.
b. A gift of $1,700 for the General Endowment Fund to be used for general purposes.

Any member may obtain additional details with respect to these financial statements by directing a letter to the Treasurer.

Respectfully submitted,

E. R. PIORE, *Treasurer*

CURRENT EXPENSE BY PURPOSE



Fiscal Year 1976 Expenditures

Government Contracts and Grants	$38,633,700
Private Grants and Projects	3,340,202
Administrative Costs	13,444,460
Total	$55,418,362

Report of the Auditing Committee

January 6, 1977

Dear Dr. Handler:

In accordance with Bylaw V-6 of the National Academy of Sciences, the firm of Price Waterhouse & Co., Washington, D.C., was retained to make an audit of the accounts of the Treasurer for the fiscal year that ended June 30, 1976, and to report to the Auditing Committee.

The independent accountants have completed their examination of the financial statements and have submitted their report, a copy of which is attached, concerning financial statements to which they refer. The Auditing Committee has reviewed the report and recommends its acceptance in compliance with the governing bylaw and that the opinion of the independent accountants be published with the report of the Treasurer.

Respectfully submitted,

H. S. YODER, *Chairman*
ROY HERTZ
ALEXANDER HOLLAENDER

Auditing Committee
National Academy of Sciences

Dr. Philip Handler, President
National Academy of Sciences
Washington, D.C.

Report of Independent Accountants

To the Auditing Committee of the National Academy of Sciences

We have examined the accompanying balance sheet (Exhibit A) of the National Academy of Sciences (including the National Academy of Engineering, the National Research Council, and the Institute of Medicine) as of June 30, 1976, the related statement of income, expenses and changes in fund balances for the year then ended (Exhibit B), and the investment schedules (Schedules 1, 1-A, 1-B, 2, 2-A, and 3). Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances, including at June 30, 1976, confirmation of investments by direct correspondence with the custodian.

As discussed in Note 6, general expenses allocated as indirect costs approximating $318,000 and $431,000 during the fiscal years ended June 30, 1976 and 1975, respectively, may be subject to partial or total disallowance as a result of DCAA examinations. The Academy intends to formally protest any proposed DCAA disallowances of these general expenses. The ultimate outcome of these matters cannot presently be determined, and no provision for any liability that may result has been made in the accompanying financial statements.

In our opinion, subject to the effects of such adjustments, if any, as might have been required had the outcome of the uncertainty referred to in the preceding paragraph been known, the accompanying financial statements examined by us present fairly the financial position of the National Academy of Sciences at June 30, 1976, and the results of their operations and the changes in their fund balances for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

PRICE WATERHOUSE & CO.

Washington, D.C.
November 9, 1976

Balance Sheets

	CURRENT FUNDS	
	GENERAL FUNDS	PROGRAM FUNDS GOVERNMENT
ASSETS		
Current Assets		
Cash	$ -	$
Certificates of deposit and short-term investments, at cost which approximates market (Schedule 3)	4,060,800	-
Accounts receivable-U.S. Government		3,950,078
Other current receivables	424,909	
Interfund receivables (payables)	(66,187)	(678,907)
Accrued interest on investments	121,419	
Inventories of publications and supplies, at the lower of cost (average basis) or market	420,599	-
Prepaid expenses and other	75,514	-
Total Current Assets	5,037,054	3,271,171
Investments in Marketable Securities, at cost (approximate market value $20,996,470 in 1976 and $21,766,902 in 1975-Schedule 1)		-
Property and Equipment, at cost (Notes 2, 3, 5, and 9)		
Land	-	-
Buildings and improvements, less accumulated depreciation of $2,138,602 in 1976 and $2,038,144 in 1975		
Leasehold improvements, less accumulated amortization of $410,726 in 1976 and $356,003 in 1975	505,458	
Furniture and equipment, less accumulated depreciation of $1,437,492 in 1976 and $1,427,538 in 1975	-	-
EDP equipment, less accumulated depreciation of $144,387 in 1976 and $97,234 in 1975		-
	505,458	-
Termination Allowance Trust Fund (Note 4)		
Cash and investments (Schedule 2)	-	6,306,098
Receivable from U.S. Government	-	1,002,616
		7,308,714
Total Assets	$5,542,512	$10,579,885
LIABILITIES AND FUND BALANCES		
Current Liabilities		
Current portion of long-term debt (Note 5)	$	$
Accounts payable and accrued expenses	1,107,166	2,064,209
Accrued annual leave and employee benefits (Note 8)	650,186	730,771
Advances on U.S. Government contracts (Note 2)	-	476,191
Deferred income (Note 2)	1,442,530	-
Total Current Liabilities	3,199,882	3,271,171
Long-term debt secured (Note 5)		-
Termination Allowance Liability (Note 4)		7,308,714
Commitments (Note 7)		
Fund Balances (Exhibit B)	2,342,630	
Total Liabilities and Fund Balances	$5,542,512	$10,579,885

EXHIBIT A

			TOTAL ALL FUNDS	
PRIVATE	TRUST AND ENDOWMENT FUNDS	PLANT FUNDS	JUNE 30, 1976	JUNE 30, 1975 AS RESTATED (NOTE 9)
$ 527,939	$ 374,961	$	$ 902,900	$ 1,082,824
2,732,700			6,793,500	6,422,500
			3,950,078	3,448,969
257,318			682,227	664,921
625,094	120,000			
21,284			142,703	139,638
71,912			492,511	415,239
			75,514	51,702
4,236,247	494,961		13,039,433	12,225,793
23,062	18,987,343		19,010,405	18,930,889
		369,471	369,471	369,471
		6,992,433	6,992,433	6,723,537
			505,458	560,180
		1,448,798	1,448,798	1,547,969
		274,023	274,023	321,176
		9,084,725	9,590,183	9,522,333
			6,306,098	6,168,873
			1,002,616	1,002,616
			7,308,714	7,171,489
$4,259,309	$19,482,304	$9,084,725	$48,948,735	$47,850,504
$	$	$ 72,452	$ 72,452	$ 67,952
105,607			3,276,982	2,892,702
76,143			1,457,100	1,466,788
			476,191	760,093
1,224,286			2,666,816	2,498,428
1,406,036		72,452	7,949,541	7,685,963
		415,949	415,949	488,401
			7,308,714	7,171,489
2,853,273	19,482,304	8,596,324	33,274,531	32,504,651
$4,259,309	$19,482,304	$9,084,725	$48,948,735	$47,850,504

Statements of Income, Expenses, and Changes in Fund Balances

FOR THE YEARS ENDED JUNE 30, 1976 AND 1975

	CURRENT FUNDS	
	GENERAL FUNDS	PROGRAM FUNDS GOVERNMENT
INCOME:		
Grants, contracts, and contributions (Notes 2 and 6)	$ 923,731	$47,228,040
Publication sales	1,623,689	—
Investment interest and dividends of the consolidated fund	552,245	—
Interest on short-term investments	298,688	—
Net gain or (loss) on sale of securities	—	—
Dues	65,695	—
Rental income	304,153	—
Other	72,698	—
	3,840,899	47,228,040
EXPENSES:		
Personal services (Note 8)		
Salaries, wages, and related benefits	7,809,743	13,844,024
Fees and other	493,949	1,795,906
Travel	483,206	3,999,052
Expenses allocated to rental areas	277,772	—
Other operating expenses	4,312,784	2,514,466
General expenses allocated as indirect costs to grants and contracts (1975 $8,929,874) (Note 6)	(9,502,889)	8,594,340
Subcontracts	36,997	7,817,717
Grants and fellowships	30,009	8,662,535
	3,941,571	47,228,040
Excess of Income (Expenses) before cumulative effect of change in accounting principle	(100,672)	—
Cumulative effect of change in accounting principle (Note 2)	—	—
EXCESS OF INCOME (EXPENSES)	(100,672)	
OTHER:		
Interfund transfers	251,394	
Building improvements and equipment acquired from current funds	(597,243)	
Depreciation expense transferred to plant fund	467,597	
	21,076	
FUND BALANCES, BEGINNING OF YEAR (AS PREVIOUSLY REPORTED)	2,288,642	
ADJUSTMENTS (Note 9)	32,912	
FUND BALANCES, BEGINNING OF YEAR (AS RESTATED)	2,321,554	
FUND BALANCES, END OF YEAR	$2,342,630	$

EXHIBIT B

			TOTAL ALL FUNDS	
PRIVATE	TRUST AND ENDOWMENT FUNDS	PLANT FUNDS	JUNE 30, 1976	JUNE 30, 1975 AS RESTATED (NOTE 9)
$3,264,381	$ 12,200	$ 1,435	$51,429,787	$52,455,654
234,904			1,858,593	1,706,399
155,188			707,433	888,343
104,468			403,156	560,746
9,192	828,349		837,541	(1,960,360)
265,148			330,843	286,981
			304,153	253,772
244,038			316,736	320,606
4,277,319	840,549	1,435	56,188,242	54,512,141
1,428,349			23,082,116	27,041,781
228,015			2,517,870	1,871,163
369,989			4,852,247	4,631,344
			277,772	258,327
912,074			7,739,324	7,394,369
908,549				
53,315			7,908,029	4,356,914
348,460			9,041,004	9,034,943
4,248,751			55,418,362	54,588,841
28,568	840,549	1,435	769,880	(76,700)
				(1,889,968)
28,568	840,549	1,435	769,880	(1,966,668)
(432,756)	323,465	(142,103)		
		597,243		
		(467,597)		
(404,188)	1,164,014	(11,022)	769,880	(1,966,668)
3,257,461	18,318,290	9,181,650	33,046,043	34,997,820
		(574,304)	(541,392)	(526,501)
3,257,461	18,318,290	8,607,346	32,504,651	34,471,319
$2,853,273	$19,482,304	$8,596,324	$33,274,531	$32,504,651

NOTES TO FINANCIAL STATEMENTS
June 30, 1976 and 1975

NOTE 1 ORGANIZATION

The National Academy of Sciences was formed under a charter that was passed as an Act of Incorporation by the United States Congress and signed into law on March 3, 1863. The Academy operates as a private, co-optative society of distinguished scholars in scientific or engineering research, dedicated to the furtherance of science and its use for the general welfare. The Academy is exempt from federal income taxes under Section 501(c)(3) of the Internal Revenue Code.

NOTE 2 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Basis of Accounting

The accounts of the Academy include the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all of which are related organizations of the Academy. The financial statements of the Academy have been prepared on the accrual basis of accounting.

In order to ensure observance of limitations and restrictions placed on the use of the resources available to the Academy, the accounts of the Academy are maintained in accordance with the principles of "fund accounting." Under this procedure resources designated or available for various purposes are classified for accounting purposes into separate funds. Separate accounts are maintained for each fund; however, in the accompanying financial statements, funds that have similar characteristics have been combined.

The unrestricted income of the Academy is accounted for in the General Fund. The income and expenses relating to activities performed under contracts with the U.S. Government are accounted for in the Government Program Fund. Grants, contributions and other restricted resources received from private individuals or organizations are accounted for in the Private Program Fund. The Trust and Endowment Fund includes gifts and bequests accepted by the Academy with the understanding that the principal and income be utilized in accordance with the terms of the gifts or bequests. Gains or losses arising from the disposition of investments are considered part of the principal of the investments and are accounted for in the Trust and Endowment Fund. The Plant Fund includes the Academy's property and equipment.

Contracts and Grants

A significant portion of the Academy's activities is performed under cost-reimbursable contracts with the U.S. Government. It is the policy of the Academy to record income on these contracts as costs are incurred. Accordingly, funds received in advance of contract performance are recorded as advances on U.S. Government contracts in the Academy's balance sheets.

Activities supported by individuals or private organizations are generally financed by grants which frequently require the refund of any unexpended funds upon completion of the project. The policy of the Academy is to recognize grant income as costs are incurred if such refunds are required. Accordingly, funds received in advance of grant performance are recorded as deferred income in the Academy's balance sheets. Income from private grants that do not require such refunds and other private restricted fund income are recognized in the year of receipt.

Translation of Currencies

As of March 31, 1975, the former Atomic Bomb Casualty Commission (ABCC) was succeeded by the Radiation Effects Research Foundation (RERF). The remaining assets and liabilities of the ABCC are included in the Government Program Fund in the accompanying financial statements and have been translated into U.S. dollars at approximate market rates of exchange prevailing at the dates of the balance sheets. Income and expenses of the ABCC through March 31, 1975 were translated generally at the free rates of exchange prevailing at each month end. It is the policy of the Academy to record exchange gains or losses when incurred. During fiscal year 1975 there were no significant exchange gains or losses.

Property, Equipment, and Depreciation

Property and equipment are stated at cost. Major improvements are capitalized, while routine replacements, maintenance, and repairs are charged to expense.

Effective July 1, 1974 the Academy began providing for depreciation on its building facilities. This policy was adopted to recognize the cost of all resources available to the Academy to carry out its objectives. Depreciation of building facilities for fiscal years prior to July 1, 1974 was charged to the Plant Fund in fiscal year 1975 as "cumulative effect of change in accounting principle."

Depreciation of the Academy's buildings and equipment is generally computed on a straight-line basis using the following lives: buildings and improvements–40 to 50 years; furniture and equipment–10 years; and EDP equipment–8 years. Leasehold improvements in the Joseph Henry Building are amortized over the remaining life of the lease.

NOTE 3 PROPERTY, EQUIPMENT, AND DEPRECIATION

Depreciation and amortization expense charged to other operating expenses in the General Fund is as follows:

	Fiscal Year 1976	Fiscal Year 1975 As Restated (Note 9)
Buildings and Improvements	$142,636	$148,176
Leasehold Improvements	54,723	54,656
Furniture and Equipment	277,808	228,103
EDP Equipment	47,153	43,756

The Academy is the custodian of certain property and equipment that is owned by the U.S. Government and is furnished to the Academy for work under government contracts. The cost of these assets, which is not reflected in the accompanying balance sheets, was $13,028 and $37,743 at June 30, 1976 and 1975, respectively.

NOTE 4 RADIATION EFFECTS RESEARCH FOUNDATION

The Radiation Effects Research Foundation (RERF) began operations April 1, 1975 as a Japanese entity succeeding the Atomic Bomb Casualty Commission (ABCC). ABCC had been funded primarily by the Energy Research and Development Administration (ERDA) and administered by the Academy. The Academy continues in an advisory capacity to RERF and serves as an intermediary with respect to providing the U.S. Government's 50 percent share of the operational funds by way of a cost-reimbursable contract with ERDA.

Costs associated with operating RERF for the fiscal year ended June 30, 1976 were $4,398,213. Fiscal year 1975 costs were $8,851,660, consisting of $696,864 for RERF during the period April 1, 1975 to June 30, 1975 and $8,154,796 for ABCC from July 1, 1974 to March 31, 1975.

In accordance with a labor agreement, the Academy is liable for termination compensation to Japanese nationals who were formerly employed by the ABCC and who are now employed by RERF. The extent of the Academy's liability is that amount which had accumulated to the benefit of employees at March 31, 1975. Any benefits accruing after March 31, 1975 become an obligation of RERF. The amounts funded by ERDA have been recorded in the Termination Allowance Trust Fund which is shown in the accompanying balance sheets. Investment earnings on the Termination Allowance Trust Fund after March 31, 1975 accrue to the benefit of the employees.

In accordance with the same labor agreement, the Academy established an Employee Loan Fund for employees of the ABCC. Loans from this fund are limited to and secured by the employee's vested interest in the termination compensation reserve. Effective April 1, 1975, ERDA agreed to (a) continue the Loan Fund privilege for 1 year so as to allow RERF time to establish its own Loan Fund and (b) consider the Loan Fund an asset of the Termination Allowance Trust Fund at a fixed dollar amount of $550,000. The Termination Fund is being transferred to the control and operation of the RERF. Loan Fund privileges were extended to October 31, 1976.

As part of the negotiation for the successor organization, ERDA gave title of certain assets to the RERF. These assets, with a cost of $3,307,160, represented buildings and equipment formerly owned by the U.S. Government but in the possession of the Academy.

NOTE 5 LONG-TERM DEBT

Long-term debt consists of the following:

	June 30, 1976	June 30, 1975
7.5% secured note payable, due in monthly installments of $5,804 to April 1981	$274,023	$321,176
4% mortgage, payable in semi-annual installments of $15,000 to November 1984	214,378	235,177
	488,401	556,353
Less current portion	72,452	67,952
	$415,949	$488,401

The long-term debt is secured by land, building, and EDP equipment at a cost of $668,587 at June 30, 1976.

During fiscal year 1975, the Academy acquired certain property in Woods Hole, Massachusetts at a cost of $250,177. These facilities are being utilized by the Academy as a summer study center.

NOTE 6 GOVERNMENT CONTRACTS

The costs associated with the U.S. Government contracts are subject to audit by the Defense Contract Audit Agency (DCAA), which has completed its examinations through June 30, 1974.

The DCAA has substantially completed its examination for the fiscal year ended June 30, 1975 and has proposed to disallow certain general expenses allocated as indirect costs approximating $431,000. General expenses of a similar nature incurred during fiscal year 1976 and allocated as indirect costs approximated $318,000. The Academy believes that allocation of these general expenses as indirect costs is justified and intends to formally protest any proposed DCAA disallowances of these items. The ultimate outcome of these matters is presently not determinable. The Academy has not made provision in the 1976 financial statements for liability, if any, that may result from these items.

NOTE 7 COMMITMENTS

The Academy's lease agreements for operating facilities provide for minimum rentals as follows:

Fiscal Year	Joseph Henry Building	Watergate Offices	Print Shop Facilities	Total
1977	$ 710,000	$230,472	$60,880	$1,001,352
1978	710,000	230,472	982	941,454
1979	710,000	230,472		940,472
1980	710,000	55,788	—	765,788
1981	710,000		—	710,000
1982-1986	3,550,000	—	—	3,550,000
1987-1988	798,750	—	—	798,750

The Academy leases the Joseph Henry Building from George Washington University under an agreement that expires in fiscal year 1988. Under the terms of this agreement, the Academy is committed to pay all taxes, insurance, and maintenance on the building. Portions of the building not immediately required for Academy usage are sublet to commercial and other tenants.

The Academy leases certain space in the Watergate Office Building under various agreements that expire in fiscal years 1979 and 1980.

In addition, warehouse and print shop space is leased in Bladensburg, Maryland, under an agreement that expires in fiscal year 1978. The lease contains an option to renew at the same terms for up to five years.

Rental expense included in other operating costs totaled approximately $1,038,000 and $965,000 during fiscal years 1976 and 1975, respectively.

NOTE 8 PENSION PLAN

The Academy has a contributory pension plan covering substantially all of its employees. Effective July 1, 1973, the Academy amended the plan to provide for minimum annuities (Supplemental Plan) to certain employees who retire with more than 20 years of service.

During fiscal year 1976, the DCAA notified the Academy of its intention to disallow approximately $241,000 of prior years' Supplemental Plan costs. The Academy protested the disallowance but received an unfavorable ruling from the Administrative Contracting Officer. As a result of that ruling, $241,000 has been charged to the General Fund during fiscal year 1976 as a reduction of the general expense indirect cost allocation. These cost disallowances prompted the Academy to terminate the Supplemental Plan as of April 25, 1976. General Fund operations for fiscal year 1976 were not affected because the aforementioned charge was offset by a credit of $241,000 arising from the reversal of the liability recorded in the prior two fiscal years.

The Academy is making arrangements to purchase annuities during fiscal year 1977 to fund its legal obligation to former employees eligible for supplemental benefits who retired prior to the termination of the Supplemental Plan. Management of the Academy estimates that the cost of these annuities will amount to approximately $300,000. Approximately $254,000 of this amount will be reimbursable to the Academy in equal installments over a ten-year period as part of the cost of Program Fund activities beginning in fiscal year 1977. The remaining $46,000 of expense will be borne by the Academy and has been charged to the General Fund during fiscal year 1976.

The Academy recognizes a liability approximating $194,000 to present employees entitled to supplemental benefits earned prior to the termination of the plan on April 25, 1976. During the current year, the Academy funded approximately $93,000 with a trustee on behalf of these employees. Deferred compensation agreements for the remaining $101,000 of liability will be executed during fiscal year 1977. The costs associated with the funding and compensation agreements are not reimbursable under current or future year Program Fund activities. Accordingly, $194,000 of expense has been charged to the General Fund during fiscal year 1976.

Pension expense for the fiscal years ended June 30, 1976 and 1975, exclusive of the supplemental benefit adjustments noted above, amounted to approximately $1,611,000 and $1,476,000, respectively. The Academy's policy is to fund accrued pension expense.

NOTE 9 PRIOR PERIOD ADJUSTMENT

Accumulated depreciation relating to property and equipment at June 30, 1975 was understated by $574,304 as a result of inadvertent under provisions of depreciation over an extended period of years. This amount has been recorded as an adjustment relating to prior periods, thereby increasing accumulated depreciation and decreasing Plant Fund balance at July 1, 1975 by $574,304. The resultant restatement of the financial statements for the fiscal year ended June 30, 1975 had the effect of increasing the excess of expenses previously reported by $14,891 after giving recognition to an expected recovery of $32,912 of expense upon the completion of the DCAA examination of fiscal year 1975 costs.

Consolidated Fund

	BALANCE JUNE 30, 1975 (AT COST)	ADDITIONS (AT COST)
FIXED INCOME SECURITIES (Schedule 1-A)		
Cash Equivalents	$ 1,804,000	$ 9,517,189
Convertible Bond	100,000	—
Other Bonds and Notes	2,355,969	3,463,213
Total Fixed Income Securities	4,259,969	12,980,402
COMMON STOCK (Schedule 1-B)	14,670,920	11,914,497
Total Investments	18,930,889	$24,894,899
Uninvested Cash	1,418	
Net Payable for Securities Transactions	(476,290)	
TOTAL CONSOLIDATED INVESTMENT FUND	$18,456,017	
Less: Investment Advisory Fees		

SCHEDULE 1

SALES AND REDEMPTIONS				
PROCEEDS	NET GAIN OR (LOSS)	BALANCE JUNE 30, 1976 (AT COST)	QUOTED MARKET JUNE 30, 1976	INVESTMENT INCOME YEAR ENDED JUNE 30, 1976
$10,718,203	$ —	$ 602,986	$ 602,986	$ 81,039
100,000	—	—	—	3,656
1,938,216	(61,159)	3,819,807	3,813,111	254,917
12,756,419	(61,159)	4,422,793	4,416,097	339,612
12,896,505	898,700	14,587,612	16,580,373	403,308
$25,652,924	$837,541	19,010,405	20,996,470	742,920
		372,457	372,457	
		—	—	
		$19,382,862	$21,368,927	
				(35,487)
				$707,433

Fixed Income Securities— Consolidated Fund

JUNE 30, 1976

	INTEREST RATE	MATURITY	PRINCIPAL AMOUNT	COST	QUOTED MARKET
CASH EQUIVALENTS					
General Motors Acceptance Corp.	5.00%	Demand	$300,000	$300,000	$300,000
Sears Roebuck Acceptance Corp.	5.25%	Demand	300,000	300,000	300,000
U.S. Treasury Bill	—	7/1/76	3,000	2,986	2,986
TOTAL CASH EQUIVALENTS			$603,000	$602,986	$602,986

SCHEDULE 1-A

OTHER BONDS AND NOTES	INTEREST RATE	MATURITY	PRINCIPAL AMOUNT	COST	QUOTED MARKET
Allied Chemical Corporation	9.00%	2000	$ 250,000	$ 250,625	$ 250,000
American Telephone and Telegraph Co.	8.75%	2000	200,000	195,250	206,250
Beneficial Corporation	9.75%	1979	250,000	262,500	264,687
Chesebrough-Ponds, Inc.	5.00%	1976	10,000	10,000	10,000
Commonwealth Edison Co. First Mortgage	8.75%	2005	250,000	250,000	247,187
Federal National Mortgage Association	7.65%	1985	250,000	247,578	245,000
General Electric Corp.	8.60%	1985	250,000	250,000	257,812
General Telephone Co.	9.25%	1999	100,000	101,000	101,000
Halliburton Company	7.95%	1995	250,000	250,656	234,220
International Bank for Reconstruction and Development	8.30%	1980	250,000	250,000	251,875
International Bank for Reconstruction and Development	8.00%	1981	250,000	250,000	250,000
National Rural Utilities Cooperative Finance Corp.	8.950%	1985	250,000	257,812	257,345
NCNB Corporation	8.40%	1995	250,000	250,000	231,250
Sohio/BP Trans. Alaska Pipeline Capital Inc.	10.625%	1993	250,000	249,542	262,500
U.S. Treasury Bond	7.50%	1993	250,000	244,219	241,875
U.S. Treasury Note	7.875%	1986	250,000	250,625	250,235
Weyerhauser Company	8.625%	2000	250,000	250,000	251,875
TOTAL OTHER BONDS AND NOTES			$3,810,000	$3,819,807	$3,813,111

Common Stocks—Consolidated Fund

JUNE 30, 1976

	NUMBER OF SHARES	COST	QUOTED MARKET
Airco, Inc.	10,000	$ 250,323	$ 328,750
American Express Co.	12,000	436,263	438,000
American Home Products Corp.	6,000	215,370	205,500
American Standard, Inc.	10,000	244,681	248,750
American Telephone & Telegraph Co.	8,000	413,965	452,000
Armstrong Cork Co.	10,000	210,496	260,000
Atlantic Richfield Co.	1,000	100,477	104,500
Avon Products, Inc.	10,000	382,700	472,500
Bethlehem Steel Corp.	6,000	264,750	273,000
Burlington Industries, Inc.	5,000	158,250	126,250
Celanese Corp.	2,500	141,686	127,187
Cincinnati Milacron, Inc.	10,000	266,900	350,000
Citicorp	15,000	532,643	541,875
Coca-Cola Company	4,000	397,446	336,500
Consolidated Freightways, Inc.	5,555	100,000	132,626
Continental Corp.	2,500	118,381	120,000
Continental Oil Co.	1,000	40,040	38,375
Crown Zellerbach Corp.	5,000	120,639	220,000
Dana Corporation	15,000	353,038	390,000
Diamond Shamrock Corp.	600	47,669	47,250
Digital Equipment Corp.	2,500	128,144	441,875
Dow Chemical Company	5,000	144,112	241,250
E. I. duPont de Nemours & Co.	2,000	308,500	279,000
Eastman Kodak Company	4,000	170,757	400,500
Economics Laboratory, Inc.	5,000	234,644	127,500
Engelhard Minerals & Chemicals Corp.	5,000	152,712	171,250
Firestone Tire & Rubber Co.	6,000	152,125	138,000
Fischbach & Moore, Inc.	2,000	61,259	60,500
General Electric Company	10,000	552,204	571,250
General Motors Corp.	8,000	536,750	548,000
Giddings & Lewis, Inc.	20,000	203,695	187,500
Hammermill Paper Co.	2,500	59,369	55,312
International Business Machines Corp.	5,000	600,412	1,383,750
Johnson and Johnson	2,000	245,246	168,000
Kaiser Aluminum & Chemical Corp.	10,000	310,378	378,750
Kellogg Company	4,000	101,475	102,500
S. S. Kresge Company	12,000	398,239	426,000
Louisville Gas & Electric Co.	5,000	110,056	114,375
Lowenstein M. & Sons, Inc.	10,000	176,405	170,000
McLean Trucking Co.	2,000	100,022	102,250
Melville Corporation	15,000	118,938	326,250

SCHEDULE 1-B

	NUMBER OF SHARES	COST	QUOTED MARKET
Merck & Company, Inc.	3,000	$ 222,623	$ 216,000
Mobil Corporation	7,000	336,983	419,125
National Distillers & Chemical Corp.	15,000	323,135	408,750
Owens-Corning Fiberglas Corp.	1,000	52,955	51,500
Pacific Gas & Electric Co.	7,500	166,837	152,812
Pennzoil Offshore Gas Operators, Inc.	14,000	196,812	210,000
Perkin Elmer Corporation	7,500	193,085	176,250
Pitney-Bowes, Inc.	7,000	115,055	117,250
Revlon, Inc.	4,000	282,880	336,000
Schering-Plough Corp.	5,000	326,812	268,750
Joseph Schlitz Brewing Co.	10,000	511,912	192,500
Schlumberger Ltd.	3,500	177,198	304,500
Scott Paper Co.	10,000	224,225	216,250
Sears, Roebuck & Company	6,000	394,433	388,500
Southern Pacific Company	2,500	87,705	85,937
Squibb Corporation	7,500	293,598	246,562
Sunstrand Corporation	3,500	87,106	123,812
Sybron Corporation	5,000	103,924	100,625
Texaco, Inc.	15,000	356,000	421,875
Texas Oil & Gas Corp.	10,000	157,500	217,500
United Telecommunications, Inc.	16,000	236,850	240,000
Yellow Freight System, Inc.	2,000	78,825	79,000
TOTAL COMMON STOCKS		$14,587,612	$16,580,373

Termination Allowance Trust Fund

	BALANCE JUNE 30, 1975 (AT COST)	ADDITIONS (AT COST)
Investments–United States		
Cash Savings (Schedule 2-A)	$1,319,300	$ 303,279
Cash Equivalents (Schedule 2-A)	4,280,000	56,080,000
Total–U.S.	5,599,300	56,383,279
Investments–Japan		
Employee Loan Fund	550,000	–
Employee Loan Fund Interest	4,336	25,598
Total–Japan	554,336	25,598
Total Investments	6,153,636	$56,408,877
Uninvested Cash	850	
Accrued Interest Receivables–U.S.	12,399	
Accrued Interest Receivables–Japan	1,988	
Total Investment Fund	$6,168,873	

Less: Income Allocated to Former ABCC Employees

SCHEDULE 2

SALES AND REDEMPTIONS		BALANCE JUNE 30, 1976 (AT COST)	QUOTED MARKET JUNE 30, 1976	INVESTMENT INCOME–YEAR ENDED JUNE 30, 1976
PROCEEDS	NET GAIN OR (LOSS)			
$ 1,184,437	$ –	$ 438,142	$ 438,142	$ 30,866
55,080,000	–	5,280,000	5,280,000	264,592
56,264,437	–	5,718,142	5,718,142	295,458
–	–	550,000	550,000	–
–	–	29,934	29,934	26,232
–	–	579,934	579,934	26,232
$56,264,437	$ –	6,298,076	6,298,076	
		–	–	
		5,400	5,400	
		2,622	2,622	
		$6,306,098	$6,306,098	321,690
				(321,690)
				$ –

SCHEDULE 2-A

Investments—Termination Allowance Trust Fund

JUNE 30, 1976

	INTEREST RATE	MATURITY	PRINCIPAL AMOUNT	COST	QUOTED MARKET
CASH SAVINGS AND EQUIVALENTS					
American Security and Trust Savings	4.50%	Demand	$ 438,142	$ 438,142	$ 438,142
Total Savings			438,142	438,142	438,142
General Motors Acceptance Corp. Commercial Paper	5.75%	9/09/76	4,280,000	4,280,000	4,280,000
International Harvester Commercial Paper	5.625%	7/06/76	1,000,000	1,000,000	1,000,000
Total Cash Equivalents			5,280,000	5,280,000	5,280,000
Total Cash and Equivalents			$5,718,142	$5,718,142	$5,718,142

SCHEDULE 3

Investment of Working Capital Funds

AS OF JUNE 30, 1976

PRINCIPAL	TYPE AND DESCRIPTION	MATURITY	INTEREST RATE	PURCHASE DATE	AMOUNT
	CERTIFICATES OF DEPOSIT				
2,000,000	Manufacturers Hanover Trust Bank (MGT)	7/01/76	5.20%	4/01/76	$2,000,000
300,000	Washington-Lee Savings & Loan	8/02/76	5.75%	5/03/76	300,000
300,000	Continental Illinois (AS&T)	8/05/76	5.00%	5/07/76	300,000
200,000	First National Bank Chicago (AS&T)	8/12/76	5.125%	5/14/76	200,000
100,000	First Federal Savings & Loan of Arlington	8/14/76	6.00%	5/14/76	100,000
500,000	Bankers Trust Co. of New York (AS&T)	8/25/76	5.70%	5/27/76	500,000
100,000	First Federal Savings & Loan of Arlington	8/28/76	6.00%	5/28/76	100,000
100,000	Chase Manhattan Bank (Union First National)	9/08/76	5.75%	6/09/76	100,000
100,000	First Federal Savings & Loan of Arlington	9/14/76	6.00%	6/14/76	100,000
100,000	Columbia Federal Savings & Loan	9/19/76	5.75%	5/19/76	100,000
100,000	Columbia Federal Savings & Loan	9/20/76	5.75%	5/20/76	100,000
100,000	Washington-Lee Savings & Loan	10/18/76	6.25%	6/18/76	100,000
400,000	First Federal Savings & Loan of Arlington	5/14/77	6.75%	5/14/76	400,000
	Subtotal				4,400,000
	COMMERCIAL PAPER				
1,555,000	International Harvester (Union First National)	7/12/76	5.25%	4/12/76	1,555,000
	Subtotal				5,955,000
	SAVINGS				
838,500	American Security & Trust	N/A	4.50%	N/A	838,500
	Total of Working Capital Investments				6,793,500
	Uninvested Cash from MGT				239
	TOTAL				$6,793,739

Equity in Endowment, Trust, and Restricted Funds

JUNE 30, 1976

	NUMBER OF PARTICIPATING CAPITAL UNITS (PCU)	CAPITAL CONTRIBUTION	ADDITION FROM EARNED INCOME
ENDOWMENT FUNDS (income from which is for general purposes)			
Agassiz Fund	521.24	$ 50,000	$ –
Carnegie Endowment Fund	35,298.97	3,275,000	–
Commonwealth Fund	2,061.09	500,000	–
Eckart Fund	841.79	180,703	–
Ford Foundation Fund	20,706.79	5,000,000	–
Nealley Fund	204.49	19,556	–
Rockefeller Foundation Fund	4,252.60	1,000,000	–
Sloan Foundation Endowment Fund	4,254.14	1,000,000	–
General Endowment Fund	1,877.68	411,474	–
	70,018.79	11,436,733	–
TRUST FUNDS (Income from which is for specific purposes)			
Applied Mathematics and Numerical Analysis Fund	–	–	–
Henryk Arctowski Fund	905.28	95,736	52,403
Bache Fund	640.55	60,000	41,500
Billings Fund	245.46	26,067	4,000
Blaauw Fund	536.45	71,299	33,201
Blakeslee Fund	–	–	–
John J. Carty Fund	298.58	25,000	10,000
Thomas L. Casey Endowment Fund	3,557.98	258,081	214,300
Comstock Fund	229.94	10,400	29,747
Arthur L. Day Fund	6,671.52	1,399,642	48,000
Draper Fund	141.53	6,000	11,000
Eddy Fund	85.27	20,000	–
Elliot Fund	84.20	8,000	–
Gibbs Fund	111.10	5,173	6,453
Gibbs Brothers Fund	126.21	24,000	2,600
Gould Fund	441.92	40,000	28,578
Joseph Henry Fund	591.95	39,740	33,024
Hunsaker Fund	150.25	24,750	7,700
Hunt Fund	39.20	10,465	–
Kobelt Fund	1,247.71	290,952	–
Kovalenko Fund	387.89	43,741	7,000
Marsh Fund	201.97	10,000	8,700
George P. Merrill Fund	45.77	10,000	–
Murray Fund	112.77	6,000	5,500
Pradel Fund	164.40	16,392	14,908

SCHEDULE 4

CUMULATIVE REALIZED CAPITAL GAIN (LOSS)	TOTAL EQUITY IN CONSOLIDATED FUND	SHORT TERM INVESTMENTS	CASH	TOTAL FUND EQUITY
$ 46,220	$ 96,220	$ —	$ —	$ 96,220
3,216,094	6,491,094	—	—	6,491,094
24,881	524,881	—	—	524,881
11,247	191,950	—	2,503	194,453
261,581	5,261,581	—	—	5,261,581
18,132	37,688	—	—	37,688
61,851	1,061,851	—	—	1,061,851
60,824	1,060,824	—	—	1,060,824
20,350	431,824	—	—	431,824
3,721,180	15,157,913	—	2,503	15,160,416
—	—	34,800	1,725	36,525
45,818	193,957	29,500	2,066	225,523
38,250	139,750	29,200	2,453	171,403
13,443	43,510	8,000	2,017	53,527
9,413	113,913	7,000	2,988	123,901
—	—	425,500	8,619	434,119
23,937	58,937	17,000	1,780	77,717
241,358	713,739	67,000	3,832	784,571
10,177	50,324	2,000	1,929	54,253
117,586	1,565,228	35,900	18,477	1,619,605
9,969	26,969	6,300	888	34,157
(289)	19,711	28,000	1,402	49,113
7,466	15,466	4,000	721	20,187
9,832	21,458	—	1,059	22,517
4,710	31,310	—	(947)	30,363
25,765	94,343	4,000	2,256	100,599
45,939	118,703	16,000	1,199	135,902
6,253	38,703	—	554	39,257
(321)	10,144	2,000	1,039	13,183
13,954	304,906	9,000	2,223	316,129
28,525	79,266	7,000	1,568	87,834
18,711	37,411	—	3,263	40,674
1,581	11,581	1,500	715	13,796
9,458	20,958	—	(1,272)	19,686
3,211	34,511	5,000	1,883	41,394

	NUMBER OF PARTICIPATING CAPITAL UNITS (PCU)	CAPITAL CONTRIBUTION	ADDITION FROM EARNED INCOME
TRUST FUNDS–continued (Income from which is for specified purposes)			
H. P. Robertson Lectureship Fund	109.00	$ 20,325	$ 3,000
Slipher Fund	–	–	–
Smith Fund	252.29	8,000	41,000
Thompson Fund	107.98	10,000	700
Troland Fund	748.45	212,000	–
U.S. Steel Award in Molecular Biology	287.72	80,900	–
Waksman Award	–	–	–
Walcott Fund	52.12	5,000	–
G. K. Warren Fund	74.34	15,000	1,500
Watson Fund	361.02	25,000	19,400
Zworykin Fund	–	–	–
	19,010.82	2,877,663	624,214
RESTRICTED FUNDS			
Copernicus Fund	–	–	–
John A. Hutcheson	27.68	6,425	–
International Union of Physiological Sciences Congress	17.30	4,900	–
President's Deferred Compensation	240.06	58,750	–
International Union of Radio Science	42.43	10,000	–
	327.47	80,075	–
Total Equity	89,357.08	$14,394,471	$624,214
Borrowed from Carnegie Endowment Fund for leasehold improvements to Joseph Henry Building			
Investments and Cash			

Value of Participating Capital Unit:	
June 30, 1975	$239.38
September 30, 1975	204.55
December 31, 1975	217.61
March 31, 1976	239.20
June 30, 1976	237.65

SCHEDULE 4
continued

CUMULATIVE REALIZED CAPITAL GAIN (LOSS)	TOTAL EQUITY IN CONSOLIDATED FUND	SHORT TERM INVESTMENTS	CASH	TOTAL FUND EQUITY
$ 3,524	$ 26,849	$ 6,000	$ 743	$ 33,592
—	—	12,000	581	12,581
12,469	61,469	2,000	534	64,003
9,317	20,017	—	(1,219)	18,798
17,226	229,226	4,000	3,501	236,727
621	81,521	15,000	1,912	98,433
—	—	24,000	1,027	25,027
4,622	9,622	800	1,100	11,522
2,495	18,995	—	694	19,689
25,112	69,512	17,000	2,249	88,761
—	—	500	562	1,062
760,132	4,262,009	820,000	74,121	5,156,130
—	—	30,000	2,529	32,529
334	6,759	—	56	6,815
398	5,298	—	541	5,839
1,128	59,878	3,500	1,298	64,676
1,005	11,005	24,000	1,326	36,331
2,865	82,940	57,500	5,750	146,190
$4,484,177	$19,502,862	$877,500	$ 82,374	$20,462,736
	(120,000)			
	$19,382,862			

SCHEDULE 4-A

Sources and Purposes of Trust and Endowment Fund

JUNE 30, 1976

A. Funds whose income may be used for general purposes:

AGASSIZ FUND: Bequest of Alexander Agassiz, a member of the Academy.	$ 50,000
CARNEGIE ENDOWMENT FUND: Balance of gift of $5,000,000 of the Carnegie Corporation of New York in 1919, for the purposes of the National Academy of Sciences–National Research Council, $1,725,000 of which has been used to cover the cost of the Academy building and the acquisition of other property.	3,275,000
COMMONWEALTH ENDOWMENT FUND: A grant of the Commonwealth Fund in 1968 for capital endowment of the Academy.	500,000
CARL ECKART FUND: Bequest of Carl Eckart received in 1975 for the general purposes of the Academy.	180,703
FORD FOUNDATION FUND: A grant of The Ford Foundation in 1967 to the National Academy of Sciences for capital endowment.	5,000,000
NEALLEY FUND: Bequest of George True Nealley in 1925 for the general purposes of the Academy.	19,556
ROCKEFELLER FOUNDATION FUND: A grant of The Rockefeller Foundation in 1967 to the National Academy of Sciences for general purposes.	1,000,000
SLOAN FOUNDATION ENDOWMENT FUND: A grant of $1,000,000 of the Alfred P. Sloan Foundation in 1968 for the general purposes of the Academy.	1,000,000
GENERAL ENDOWMENT FUND: Bequest of David Lloyd Fillman in 1970 and others for general purposes of the Academy. During fiscal year 1976, the International Critical Tables was transferred into this fund by action of the Council.	411,474

B. Funds whose income may be used for specifically designated purposes:

APPLIED MATHEMATICS AND NUMERICAL ANALYSIS FUND: Gift of the International Business Machines Corporation to support the NAS Award in Applied Mathematics and Numerical Analysis by an award of $5,000 approximately every three years.	22,800
HENRYK ARCTOWSKI FUND: Bequest of Jane Arctowska in 1958, in memory of her husband Henryk Arctowski, for the promotion and study of solar activity changes of short or long duration and their effects upon the ionosphere and terrestrial atmosphere.	95,736

SCHEDULE 4-A
continued

BACHE FUND: Bequest of Alexander Dallas Bache, a member of the Academy (1870), to aid researches in physical and natural sciences.	$ 60,000
BILLINGS FUND: Bequest of Mrs. Mary Ann Palmer Draper (Mrs. Henry Draper) in 1915, to support the publication of the Proceedings of the Academy or for other purposes to be determined by the Academy.	26,067
BLAAUW FUND: Bequest of Marianne Blaauw in 1951 to establish the Edmond and Marianne Blaauw Fund to support research in the field of ophthalmology.	71,299
BLAKESLEE FUND: Bequest of Albert Francis Blakeslee, the income of which is to be used in support of genetics research.	400,000
JOHN J. CARTY FUND: Gift of the American Telephone & Telegraph Company on November 13, 1930, in recognition of the distinguished achievements of John J. Carty, and as a lasting testimonial of the love and esteem in which he was held by his many thousands of associates in the Bell System, for a gold medal and award for noteworthy and distinguished accomplishments in any field of science.	25,000
THOMAS LINCOLN CASEY ENDOWMENT FUND: Bequest of Thomas L. Casey in 1954, as a memorial to his father, Thomas Lincoln Casey, to be used in the advancement of engineering in all its applications.	258,081
COMSTOCK FUND: Gift of General Cyrus B. Comstock, a member of the Academy (1907), to promote researches in electricity, magnetism, or radiant energy through the Comstock Prize to be awarded for notable investigations.	10,400
ARTHUR L. DAY FUND: A bequest of Arthur L. Day, a member of the National Academy of Sciences, for the purpose of advancing studies of the physics of the earth.	1,398,474
DRAPER FUND: Gift of Mrs. Henry Draper in 1883, in memory of her husband, a former member of the Academy, to found the Henry Draper Medal to be awarded for notable investigations in astronomical physics; the balance of income is applied to aid research in this science.	6,000
NATHAN B. EDDY MEMORIAL AWARD FUND: Contributions made in memory of Nathan B. Eddy for his work with the Committee on Problems of Drug Dependence. The funds are used for an award and medal for work in the field by an individual selected by the Committee.	20,000

SCHEDULE 4-A
continued

ELLIOT FUND: Gift of Margaret Henderson Elliot to found the Daniel Giraud Elliot Gold Medal and Honorarium for the most meritorious work on zoology or paleontology published in each year.	$ 8,000
GIBBS FUND: Established by gift of Wolcott Gibbs, a member of the Academy (1892), and increased by a bequest of the late Morris Loeb in 1914 for the promotion of research in chemistry.	5,173
GIBBS BROTHERS FUND: Gift of William Francis Gibbs and Frederic H. Gibbs in 1963 to found The Gibbs Brothers Medal for outstanding contribution in the field of naval architecture and marine engineering.	24,000
GOULD FUND: Gift of Mrs. Alice Bache Gould in 1897 in memory of her father, a former member of the Academy, for the promotion of research in astronomy, and supplemented by a bequest of $20,000 from the estate of Alice Bache Gould received in 1954.	40,000
JOSEPH HENRY FUND: Contributions by Fairman Rogers, Joseph Patterson, George W. Childs, and others as an expression of their respect and esteem for Joseph Henry, for the establishment of a fund to assist meritorious investigators, especially in the direction of original research.	39,740
HUNSAKER FUND: Gift of Mr. and Mrs. J. C. Hunsaker in 1964 to found an Academy award in the field of aeronautical engineering.	24,750
FRANKLIN LIVINGSTON HUNT FUND: Bequest of Franklin Livingston Hunt for aid to research in physics, chemistry, and preventive medicine. A portion of the income may also be used from time to time to provide a medal to be known as the Franklin Livingston Hunt Medal for distinguished accomplishment in scientific research.	10,465
KOBELT FUND: Bequest of Nina I. Kobelt to be used for research scholarships for worthy students.	290,952
KOVALENKO FUND: Gift of Michael S. Kovalenko, 1948–1949, in memory of his wife, to found the Jessie Stevenson Kovalenko Gold Medal for meritorious research in medical sciences.	43,741
MARSH FUND: Bequest of Othniel Charles Marsh, a member of the Academy (1909), to promote original research in the natural sciences.	10,000

GEORGE P. MERRILL FUND: Gift of Mrs. George P. Merrill in 1956, the income from which is to be used for studies of meteors, meteorites, and space.	$ 10,000
MICROBIOLOGY AWARD: Gift of the Foundation for Microbiology for an award of $5,000 every two years to be known as the Foundation for Microbiology Award in Microbiology.	10,000
MOLECULAR BIOLOGY AWARD: Funds contributed by the U.S. Steel Foundation for an annual award of $5,000 for scientific research by a relatively young investigator in the field of molecular biology or other scientific field selected by the Academy.	80,900
MURRAY FUND: Gift of the late Sir John Murray in 1911 to found the Alexander Agassiz Gold Medal in honor of a former member and president of the Academy, to be awarded for original contributions to the science of oceanography.	6,000
PRADEL FUND: A bequest of Jules Pradel in 1947 to be applied to work on the human central nervous system and allied subjects.	16,392
H. P. ROBERTSON LECTURESHIP FUND: Contributions by friends of H. P. Robertson, Foreign Secretary of the Academy at the time of his death (1962), to establish a lectureship under which distinguished scientists would be invited from anywhere in the world to present lectures to be known as the Robertson Memorial Lecture of the National Academy of Sciences.	20,325
SMITH FUND: Gift of Mrs. J. Lawrence Smith in 1884, in memory of her husband, a former member of the Academy, to found the J. Lawrence Smith Gold Medal to be awarded for important investigations of meteoric bodies and to assist, by grants of money, research concerning such objects.	8,000
THOMPSON FUND: Gift of Mrs. Mary Clark Thompson, in 1919, for a gold medal of appropriate design, to be known as the Mary Clark Thompson Gold Medal, to be awarded for important services to geology and paleontology.	10,000
TROLAND FUND: Bequest of Leonard T. Troland to be known as the Troland Foundation for Research in Psychophysics. The income to be expended with a view to the actual advancement of scientific knowledge within the field of psychophysics.	212,000
WALCOTT FUND: Gift of Mrs. Mary Vaux Walcott in 1928, in honor of her husband, a former member and president of the Academy, for the award of medals and honoraria to persons, the results of whose published researches, explorations, and discoveries in pre-Cambrian or Cambrian life and history shall be judged most meritorious; the award to be known as the Charles Doolittle Walcott Medal.	5,000

SCHEDULE 4-A
continued

G. K. WARREN FUND: Gift of Miss Emily B. Warren, 1966, in memory of her father, a member of the Academy, the income to be used for an award to be known as the G. K. Warren Prize in any field of science.	$ 15,000
WATSON FUND: Bequest of James Craig Watson, a member of the Academy (1874), for the promotion of astronomical sciences through the award of the Watson Gold Medal and grants of money in aid of research.	25,000
ZWORYKIN FUND: Gift of the RCA Corporation to support the V. K. Zworykin award of the National Academy of Engineering for outstanding achievements in the field of electronic engineering in the service of mankind.	5,000

SCHEDULE 5

Expenditures from Current Funds

FOR THE YEAR ENDED JUNE 30, 1976

CURRENT GENERAL FUNDS

NATIONAL ACADEMY OF SCIENCES

Program Administration	
Executive Office	$ 1,047,992
Program Initiation and Development	246,520
Membership Activities	157,676
	$ 1,452,188
General Administration	
Archives and Record Management	$ 128,621
Office of the Business Manager	395,714
Operations and Maintenance of Buildings and Grounds	865,935
Rental and Operation of Joseph Henry Building OTHER	218,905
Rental and Operation of Joseph Henry Building NAS	1,350,642
Rental and Operation of Other Outside Space	442,493
Depreciation of Equipment	181,111
Building Depreciation	139,363
Office of General Services	115,836
Receiving, Stockroom, and Mail Service	227,126
Security Office	55,892
Telephone Service	299,785
Office of Comptroller	177,338
Accounting Office	753,235
Personnel Office	288,650
Health Services	49,867
Office of Information	411,642
President's Allowance	31,970
Reference Library	159,536
Staff Benefits	(144,880)
Forum Planning Office	68,664
Food Service	61,843
Moving Expenses	44,763
General Activities	186,890
	$ 6,510,941

SCHEDULE 5
continued

Dissemination of Information and Publication Activities			
Printing and Publishing Office Management and Publications		$ 909,180	
Proceedings		840,526	
		$ 1,749,706	
TOTAL NATIONAL ACADEMY OF SCIENCES			$ 9,712,835
NATIONAL ACADEMY OF ENGINEERING			
Program Administration			
Council		$ 9,955	
Executive Office		285,076	
Membership Services		40,957	
Meetings and Conferences		20,743	
International Activities		30,572	
Development Activities		5,319	
		$ 392,622	
TOTAL NATIONAL ACADEMY OF ENGINEERING			$ 392,622
NATIONAL RESEARCH COUNCIL			
Program Administration			
Assembly of Behavioral and Social Sciences		$ 231,002	
Assembly of Life Sciences	$ 306,851		
–Division of Biology and Agriculture	91,055		
–Division of Medical Sciences	74,347	472,253	
Assembly of Mathematical and Physical Sciences	$ 159,205		
–Division of Chemistry and Chemical Technology	76,813		
–Division of Earth Sciences	83,822		
–Division of Mathematical Sciences	42,910		
–Division of Physical Sciences	42,720	405,470	
Assembly of Engineering		317,676	
Commission on Natural Resources		166,835	
Commission on Human Resources		194,831	
Commission on International Relations		228,893	
Commission on Sociotechnical Systems		215,795	
		$ 2,232,755	
TOTAL NATIONAL RESEARCH COUNCIL			$ 2,232,755

SCHEDULE 5
continued

INSTITUTE OF MEDICINE

Program Administration

Direction and Support		$ 452,693	
Council		18,012	
Membership Committee		57,003	
Program Committee		24,323	
Program Development		333,074	
Resource Development		64,103	
Public Information and Reports		86,268	
Annual and Semi-Annual Meetings		27,009	
International Activities		43,763	
		$ 1,106,248	
TOTAL INSTITUTE OF MEDICINE			$ 1,106,248
General Expenses Allocated as Indirect Costs to Grants and Contracts			(9,502,889)
TOTAL CURRENT GENERAL FUNDS			$ 3,941,571

CURRENT RESTRICTED FUNDS

Government-Financed Activities

NATIONAL ACADEMY OF SCIENCES

Advisory and Research

Committee on Science and Public Policy (NSF)	$ 126,077		
Committee on the Survey of Materials Science and Engineering (NSF)	15,946		
Effects of Nuclear Weapons Attacks (ARMS CONTROL)	9,229		
Federal Allocation Process for Funding Scientific Research (NSF)	67,315		
	$ 218,567		
Conferences and Symposia			
Academy Forum (HEW)	$ 35,275		
TOTAL NATIONAL ACADEMY OF SCIENCES		$ 253,842	

SCHEDULE 5
continued

INSTITUTE OF MEDICINE

Advisory and Research Activities

Social Security Studies (HEW)	$ 1,562,645	
Evaluation Study of Health Care Quality Assurance Programs (HEW)	249,474	
	$ 1,812,119	

Conferences and Symposia

Conference on Care of Elderly (HEW)	$ 11,869	
Various Projects (less than $5,000 each)	2,953	
	$ 14,822	
TOTAL INSTITUTE OF MEDICINE		$ 1,826,941

NATIONAL RESEARCH COUNCIL

ASSEMBLY OF BEHAVIORAL AND SOCIAL SCIENCES

Advisory and Research Activities

Committee on Social Sciences in the National Science Foundation (NSF)	$ 98,154	
Evaluation Study of Fundamental Research Relevant to Education (HEW)	7,373	
Committee on Department of Labor Manpower Research and Development (LABOR)	25,151	
Committee on Vocational Education Research and Development (HEW)	216,183	
Conference on Social Policy (NSF)	5,250	
Study of Social Research and Development (NSF, EXEC OFC PRES)	313,883	
Committee on Vision (NAVY)	162,141	
Measure of Energy Consumption (FEA)	153,639	
Committee on Research on Law Enforcement and Criminal Justice (JUSTICE)	148,309	
Committee on Substance Abuse and Habitual Behavior (HEW)	5,259	
Various Projects (less than $5,000 each)	2,579	
	$ 1,137,921	

Conferences and Symposia

Study Conference on Social and Behavioral Science (NSF)	$ 18,157	
TOTAL ASSEMBLY OF BEHAVIORAL AND SOCIAL SCIENCES		$ 1,156,078

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SCHEDULE 5
continued

ASSEMBLY OF ENGINEERING

Advisory and Research Activities	
Aeronautics and Space Engineering Board (NASA)	$ 228,516
Committee on Transportation	
Bay Area Rapid Transportation Impact Committee (TRANSPORTATION)	$ 56,117
Committee on Transportation (TRANSPORTATION)	163,271
	$ 219,388
Board on Engineering and Educational Policy	
Computing Systems for Use in Chemistry Engineering Education (NSF)	$ 19,643
Space Applications Board	
Space Applications Board (NASA)	$ 273,840
Committee on Telecommunications	
Committee on Telecommunications (HUD)	$ 100,980
Metropolitan Committee for Future Telecommunication Techniques for Electricity Distribution (COMMERCE)	269,465
	$ 370,445
Marine Board	
Advisory Board on International Relations Ocean Affairs Board (STATE)	$ 6,129
NAE Marine Board (NAVY)	179,498
Studies in Seafloor Engineering (NSF)	34,982
Study of Undersea Facilities (COMMERCE)	27,747
Study on Naval Oceanographic Program (NAVY)	135,815
Review of Ocean Thermal Energy Conversion Systems (ERDA)	6,677
Various Projects (less than $5,000 each)	1,237
	$ 392,085
Tunneling Technology	
Contract for Construction of Underground Transport Facilities (TRANSPORTATION)	$ 92,167
Evaluation of Tunneling Technology (NSF)	81,531
Various Projects (less than $5,000 each)	1,338
	$ 175,036

SCHEDULE 5
continued

Committee on Public Engineering Policy			
Committee on Public Engineering Policy (NSF)	$ 89,503		
Technology of Drilling for Energy Resources (NSF)	72,730		
Committee on Transportation Workshop (ERDA)	104,563		
Role of Nuclear Power in Context of Alternative Energy Systems (ERDA)	1,022,200		
Technical Factors Contributing to Nation's Foreign Trade Position and Development (NSF)	72,458		
Technology Transfers from Direct Foreign Investment (NSF)	30,485		
	$ 1,391,939		
Total Assembly of Engineering Advisory and Research Activities		$ 3,070,892	
Conferences and Symposia			
Marine Board			
Engineering Committee on Ocean Resources (NSF)	$ 24,489		
Tunneling Technology			
Standard and Metric Conversion for Tunneling Technology (NSF)	$ 6,515		
Total Assembly of Engineering Conferences and Symposia		$ 31,004	
TOTAL ASSEMBLY OF ENGINEERING			$ 3,101,896
ASSEMBLY OF LIFE SCIENCES			
Advisory and Research Activities			
Medicine			
Drug Research Board (HEW)	$ 31,418		
Medical Advisory Committees (ARMY)	62,154		
Committee on Viral Hepatitis (HEW, ARMY)	16,942		
Research Impact on Useful Discoveries in Mental Health (HEW)	18,183		
Committee on Problems of Drug Dependence (HEW, VA)	72,887		
Study of Amdyotrophic Lateral Sclerosis (HEW)	42,997		
Study of Inborn Errors of Metabolism (NSF)	14,068		
Biological Effects of Environmental Pollutants (EPA)	367,362		
Manpower Resources and Needs in Basic Neurological and Communicative Sciences (HEW)	13,158		

SCHEDULE 5
continued

Clinical Evaluation of Narcotic Antagonists (EXEC OFC PRES)	$ 37,688
Appraisal of Manpower and Associated Health Care Resources (VA)	337,057
Study of Exposure to Ionized Radiation (EPA, HEW)	102,484
Prosthetics Orthotics and Sensory Aid Research (VA, HEW)	18,606
Microwave Radiation Effects on Naval Personnel (HEW)	81,711
Mortality from Cancer in Army World War II X-Ray Technicians (HEW)	35,425
Evaluation of Tests for Cystic Fibrosis (HEW)	50,456
Committee on Research in Prosthetics and Orthotics (HEW)	97,358
Research Training Activities in Maternal and Child Health (HEW)	66,544
NAS-NRC Twin Registry (HEW)	76,311
Medical Follow-Up Agency Studies (HEW, VA, EPA)	169,798
Prosthetics Research and Prosthetic Orthotic Education (VA)	127,511
Implications of Declining Pediatric Hospitalization Rates (HEW)	38,011
Occupational Cancer Information and Alert Program (LABOR)	45,265
X-Ray and Childhood Cancer (HEW)	115,951
2nd Workshop on Dermatopharmacology (HEW)	17,487
Epidemiologic Studies on Veterans Medical Follow-Up (VA)	162,170
VA Cancer Chemotherapy (VA)	94,901
Clinical Efficacy of Narcotic Antagonists (HEW)	17,870
Advisory Service to NLMS Toxicology Information Program (HEW)	18,399
Committee on Veterinary Medical Sciences (HEW, ERDA, AGRICULTURE)	21,979
Various Projects (less than $5,000 each)	3,364
	$ 2,375,515
Biology	
U.S. National Committee of the International Union of Nutritional Sciences (AID)	$ 48,090
Food Additives Codex (HEW)	38,819
Research and Training Needs in Food Science and Technology (HEW)	15,006
Evaluation of Human Nutrients Requirements (HEW)	34,312
Generally Regarded as Safe Substances Survey (HEW)	156,293
Guide for Care/Use of Hypertensive Rats (HEW)	10,625
Review and Assessment of World Population Food and Health (NSF)	13,514
Committee on Maternal Nutrition (HEW)	30,551
Institute of Laboratory Animal Resources (ARMY, NAVY, HEW, COMMERCE)	277,660
Various Projects (less than $5,000 each)	5,385
	$ 630,255

SCHEDULE 5
continued

Inter-Disciplinary Studies		
Toxicological Information of Selected Chemicals (EPA)	$ 53,558	
Toxicology of Hazardous Substances (EXEC OFC PRES)	69,133	
Advisory Center on Toxicology (NAVY)	166,188	
Study of Contaminants in Safe Drinking Water (EPA)	371,028	
Appraisal of Manpower and Associated Health Care Resources (VA)	3,925,253	
Review of Scientific Program of National Center for Toxicology Research (HEW)	19,669	
	$ 4,604,829	
International Activities		
U.S. National Committee for the International Union Against Cancer (HEW)	$ 10,288	
ICSP-WHO International Reference Center (HEW)	70,666	
U.S. National Committee for the International Brain Research Organization (NSF)	5,089	
Various Projects (less than $5,000 each)	9,356	
	$ 95,399	
Radiation Effects Research Foundation		
Scientific Advisory Committee (ERDA)	$ 4,002,837	
Epidemiologic Research on Cancer (HEW)	136,739	
	$ 4,139,576	
Total Assembly of Life Sciences Advisory and Research Activities		$11,845,574
Conferences and Symposia		
Medicine		
Conference on Prediction of Abuse Liability (HEW)	$ 18,521	
Various Projects (less than $5,000 each)	1,869	
	$ 20,390	
Biology		
Various Projects (less than $5,000 each)	$ 5,636	
International Activities		
XI International Cancer Congress (HEW)	$ 27,172	
U.S. National Committee for International Brain Research (HEW)	5,494	

SCHEDULE 5
continued

VII International Photobiology Congress (ERDA, HEW, NSF)	$ 11,587		
Various Projects (less than $5,000 each)	1,291		
	$ 45,544		
Total Assembly of Life Sciences Conferences and Symposia		$ 71,570	
TOTAL ASSEMBLY OF LIFE SCIENCES			$11,917,144

ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES

Advisory and Research Activities

Division of Chemistry and Chemical Technology

Office of Biochemical Nomenclature (HEW)	$ 14,616
Numerical Data Advisory Board (COMMERCE)	74,932
Committee on Hazardous Materials (TRANSPORTATION)	36,781
National Center for Computations in Chemistry (NSF, ERDA)	12,778
Conference to Evaluate Field of Crystallography (NSF)	10,498
Study on Effects of Inadvertent Modification of the Atmosphere (NASA, COMMERCE)	39,665
Thermodynamics and National Energy Problems (NSF)	154,000
Climatic Impact Committee (HEW)	12,389
Committee on Data for Science and Technology (ERDA)	10,989
Various Projects (less than $5,000 each)	1,862
	$ 368,510

Division of Earth Sciences

Committee on Seismology (VARIOUS)	$ 67,112
U.S. National Committee for Rock Mechanics (NSF, ARMY, INTERIOR, TRANSPORTATION)	50,928
U.S. National Committee for the International Hydrological Decade (NSF)	45,407
U.S. National Committee for Geochemistry (NSF, INTERIOR)	81,680
Committee on Geodesy (NAVY, COMMERCE, INTERIOR, NASA)	40,622
Various Projects (less than $5,000 each)	7,896
	$ 293,645

Division of Mathematical Sciences

Evaluation of National Crime Panel (JUSTICE)	$ 148,011
Method for Setting HEW Statistical Priorities (HEW)	37,277

Uses of Balloons for Scientific Purposes (COMMERCE)	$ 64,326	
Planning Project for Confidential Statistical Data (NSF)	69,128	
Various Projects (less than $5,000 each)	4,116	
	$ 322,858	
Division of Physical Sciences		
Geophysics Research Board (NSF, ERDA)	$ 269,097	
Committee on Nuclear Sciences (NSF, ERDA)	58,135	
Evaluation Panels for National Bureau of Standards (COMMERCE)	230,494	
Committee on Department of Transportation Climatic Impact Assessment Program (TRANSPORTATION)	7,402	
Space Science Board (NASA)	483,329	
Board on Naval Studies (NAVY)	214,068	
Solar Institute Study (ERDA)	59,331	
Symposium on Atomic Spectroscopy (NSF)	21,745	
Workshop on Nansen Drift (NAVY)	38,475	
Air Force Studies Board (AIR FORCE)	100,757	
Atmospheric R&D Activities of NOAA (COMMERCE)	25,914	
An Assessment of the National Need for Facilities Dedicated to the Production of Synchrotron Radiation (NSF, ERDA)	26,905	
Committee on Polar Research (NSF)	208,079	
Committee on Atmospheric Sciences (NSF)	56,213	
Committee on Radio Frequency Requirements for Scientific Research (NSF)	36,810	
U.S. Committee for the Global Atmospheric Research Program (NSF)	204,384	
Advisory Committee to the Army Research Office (ARMY)	61,114	
Various Projects (less than $5,000 each)	4,793	
	$ 2,107,045	
Ocean Science Board		
Committee on Oceanography (NAVY, STATE, COMMERCE, NSF, EPA, TRANSPORTATION)	$ 8,953	
Appraisal of Societal Consequences of Transportation Noise Abatement (NAVY)	184,651	
Tropospheric Transport of Pollutants to the Oceans (NSF)	23,413	
	$ 217,017	
Total Assembly of Mathematical and Physical Sciences Advisory and Research Activities		$ 3,309,075

SCHEDULE 5
continued

Conferences and Symposia			
Division of Chemistry and Chemical Technology			
Various Projects (less than $5,000 each)	$ 2,979		
Division of Earth Sciences			
International Geographical Union (NSF)	$ 9,499		
Division of Mathematical Sciences			
Travel Grant on Math Education (NSF)	$ 16,461		
Division of Physical Sciences			
Symposium on Turbulence and Drag Reduction (NSF, NAVY)	$ 22,979		
16th International Astronomical Union (NSF)	23,244		
Future Science in Space (NSF)	7,204		
Various Projects (less than $5,000 each)	6,306		
	$ 59,733		
Ocean Science Board			
Panel on International Decade of Ocean Exploration (NSF)	$ 8,935		
Various Projects (less than $5,000 each)	5,524		
	$ 14,459		
Total Assembly of Mathematical and Physical Sciences Conferences and Symposia		$ 103,131	
TOTAL ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES			$ 3,412,206
COMMISSION ON HUMAN RESOURCES			
Advisory and Research Activities			
Board on Human Resources Data and Analyses			
Doctorate Survey Program (NSF)	$ 522,207		
A Century of Doctorates (NSF)	92,184		
	$ 614,391		
Board on Fellowships and Associateships			
Naval Research Laboratory Research Associateships Programs (NAVY)	$ 387,982		
Naval Weapons Center Postdoctoral Research Associates Program (NAVY)	10,196		
	$ 398,178		

SCHEDULE 5
continued

National Board on Graduate Education			
Study of National Science Foundation (NSF)	$ 5,239		
National Research Act Feasibility Study (HEW)	566,108		
	$ 571,347		
Total Commission on Human Resources Advisory and Research Activities		$ 1,583,916	
Fellowships and Other Support of Scholars			
National Science Foundation Graduate Fellowship Program (NSF)	$ 515,871		
Naval Research Laboratory Postdoctoral Research Associateships (NAVY)	203,071		
International Atomic Energy Agency Training Program (ERDA)	522,124		
Picatinny Arsenal Research Associateship Program (ARMY)	43,826		
Ballistic Research Laboratories Resident Research Associateship Program (ARMY)	102,767		
NASA Research Associateship Program (NASA)	4,394,372		
Walter Reed Army Institute of Research Resident Research Associateship Program (ARMY)	48,890		
Environmental Studies Board—Resident Research Associateship Program (EPA)	49,980		
Natick Research Associateship Program (ARMY)	195,506		
Bureau of Mines Postdoctoral Research Associateship Program (INTERIOR)	9,050		
National Bureau of Standards Postdoctoral Research Associateship Program (COMMERCE)	18,348		
National Oceanic and Atmospheric Administration Resident Research Associateship Program (COMMERCE)	372,108		
Effects of Associateship Program (AGRICULTURE)	11,568		
USGS Postdoctoral Research Associates Program (INTERIOR)	13,115		
NSWC Postdoctoral Research Associates Program (NAVY)	16,743		
Air Force Systems Command Postdoctoral Research Associateships (AIR FORCE)	644,094		
	$ 7,161,433		
Council for the International Exchange of Scholars			
Committee on International Exchange of Scholars (STATE)	$ 981,413		
Total Commission on Human Resources Fellowships and Other Support of Scholars		$ 8,142,846	
TOTAL COMMISSION ON HUMAN RESOURCES			$ 9,726,762

SCHEDULE 5
continued

COMMISSION ON INTERNATIONAL RELATIONS

Advisory and Research Activities

Board on Science and Technology for International Development		
Board on Science and Technology for International Development (AID)	$ 708,909	
CNPQ Collaborating Program (AID)	20,878	
Study of Guayule (INTERIOR)	7,535	
International Industrialization Institute (AID)	22,947	
World Food Study (AID, NSF)	526,447	
	$ 1,286,716	
Board of International Scientific Exchange		
Advisory Committee on USSR and Eastern Europe (NSF)	$ 1,041,530	
Scholarly Communication with People's Republic of China (NSF, STATE)	680,853	
NAS Science Cooperative Program (AID)	5,130	
Advisory Board on International Relations-Ocean Affairs Board (NSF, STATE, COMMERCE)	109,813	
Systems of Fundamental Science Research in U.S.-USSR (NSF)	102,287	
	$ 1,939,613	
Board on International Organizations and Programs		
Advisory Committee on International Organizations and Programs (NSF)	$ 566,929	
International Institute of Applied Systems Analysis (NSF)	1,343,723	
Committee on International Scientific and Technological Information Programs (NSF)	147,600	
	$ 2,058,252	
Total Commission on International Relations Advisory and Research Activities		$ 5,284,581

Conferences and Symposia

Board on Science and Technology for International Development	
Flora Brazilian Amazon Basin (NSF)	$ 15,890

Board of International Scientific Exchange			
U.S.-USSR Symposium on Nucleic Acids (HEW)	$ 31,509		
U.S.-USSR Symposium Membrane Technology (HEW)	23,264		
	$ 54,773		
Total Commission on International Relations Conferences and Symposia		$ 70,663	
Fellowships and Other Support of Scholars			
Board on Science and Technology for International Development			
U.S.-Brazil Program for Postgraduate Research in Chemistry (NSF, AID)	$ 34,983		
Board on Science and Technology for International Development (AID)	30,718		
	$ 65,701		
Total Commission on International Relations Fellowships and Other Support of Scholars		$ 65,701	
TOTAL COMMISSION ON INTERNATIONAL RELATIONS			$ 5,420,945
COMMISSION ON NATURAL RESOURCES			
Advisory and Research Activities			
Board on Agriculture and Renewable Resources			
Renewable Resources for Industrial Materials (NSF)	$ 106,793		
Ocean Affairs Board (AGRICULTURE)	26,792		
Study of Jojoba Production (HEW)	20,380		
Evaluation of Gas Reserve Estimation of the Outer Continental Shelf (NSF)	136,436		
Committee on Animal Nutrition (HEW)	27,566		
Committee on Animal Nutrition Nutrient Requirement Series (AGRICULTURE)	146,491		
Various Projects (less than $5,000 each)	2,859		
	$ 467,317		
Board on Energy Studies			
Changing Climatic and Weather Patterns (ERDA)	$ 66,679		
ERDA Waste Management Practices (ERDA)	8,237		

SCHEDULE 5
continued

Committee on Remote Sensing Programs for Earth Resources Surveys (NASA)	$ 35,216		
Chemistry of Coal Utilization (ERDA, NSF)	34,373		
Committee on Radioactive Waste Management (ERDA)	61,804		
	$ 206,309		
Environmental Studies Board			
National Commission on Water Quality (EXEC OFC PRES)	$ 192,920		
Regulating Chemicals in the Environment (EPA)	21,461		
Scientific Committee on Problems of the Environment (EPA, COMMERCE)	112,157		
Environmental Studies Board (NSF, COMMERCE)	33,968		
Various Projects (less than $5,000 each)	3,728		
	$ 364,234		
Board on Mineral Resources			
Committee on Mineral Resources and the Environment (INTERIOR, NSF)	$ 34,763		
Directions and Priorities in Mineral Resources (INTERIOR)	61,448		
Elements and Compounds Associated with Mineral Resource Exploitation (INTERIOR)	34,673		
Forum on Potential Resources of Natural Gas (ERDA)	18,556		
	$ 149,440		
Special Projects			
Advisory Committee on U.S. Geological Survey Space Program for Earth Observations (NSF, INTERIOR)	$ 9,649		
Environmental Regulation Decision Making Process (EPA)	1,808,472		
	$ 1,818,121		
Total Commission on Natural Resources Advisory and Research Activities		$ 3,005,421	
Conferences and Symposia			
Board on Agriculture and Renewable Resources			
Various Projects (less than $5,000 each)	$ 587		
Total Commission on Natural Resources Conferences and Symposia		$ 587	
TOTAL COMMISSION ON NATURAL RESOURCES			$ 3,006,008

SCHEDULE 5
continued

COMMISSION ON SOCIOTECHNICAL SYSTEMS

Advisory and Research Activities

Transportation Research Board

Information Service to National Highway Safety Bureau (TRANSPORTATION)	$ 5,093
Transportation Research Board (TRANSPORTATION)	566,311
International Cooperative in Transportation Research and Development (TRANSPORTATION)	12,786
Transportation Research Board - Railroad Information System (TRANSPORTATION)	241,876
Airport Landside Capacity (TRANSPORTATION)	15,411
Training for Urban Transportation Professionals (TRANSPORTATION)	9,918
Prediction of Highway Traffic Noise (TRANSPORTATION)	6,917
Maritime Research Information Service (COMMERCE)	119,146
Report on Railroad Research Needs (TRANSPORTATION)	41,242
State of Art of Assessing Transport Related Air Quality Impact (TRANSPORTATION)	7,749
Bibliography Federal Highway Administration R&D (TRANSPORTATION)	9,560
Optimizing the Use of Materials and Energy in Transportation Construction (ERDA, FEA, TRANSPORTATION)	25,367
Urban Transit Reporting System (TRANSPORTATION)	41,542
Financing Efficient Urban Transit (TRANSPORTATION)	19,472
Strategies for Reducing Gas Consumption (TRANSPORTATION)	5,911
Transportation Research Information Service National Network (TRANSPORTATION)	98,225
Transportation Research Board Services to Urban Mass Transit Administration (TRANSPORTATION)	63,622
Various Projects (less than $5,000 each)	4,840
	$ 1,294,988

NCHRP-TRB

National Cooperative Highway Research Program (COMMERCE, TRANSPORTATION)	$ 3,731,642

Building Research Advisory Board

U.S. National Committee for the International Council for Building Research Studies and Documentation (NSF, HUD, ERDA)	$ 53,949

SCHEDULE 5
continued

Building Research Advisory Board Federal Construction Council (ARMY, NAVY, GSA, HUD)	$ 200,527
Building Skills Board Management (HEW)	8,243
Building Design Criteria for the Disabled (HEW)	280,383
U.S. National Committee for International Council for Building Research (VARIOUS)	7,901
Program on Energy Conservation in the Built Environment (ERDA)	18,333
Building Research Advisory Board Committee on Prevention and Mitigation of Flood Losses (HUD)	86,146
Various Projects (less than $5,000 each)	4,025
	$ 659,507
National Materials Advisory Board	
Materials Advisory Board - Committee on Technical Aspects of Critical and Strategic Material (GSA)	$ 86,529
National Materials Advisory Board (ARMY, NASA)	435,536
Advisory Service on Assessment of Effectiveness of Technology Transfer Through Technical Data Package (ARMY)	6,654
Fire Safety Aspects of Polymeric Materials (COMMERCE)	85,696
Materials for Shipboard Incinerators (NAVY)	36,533
Evaluation of Industrial Hazards (LABOR)	49,481
Contingency Plans for Chromium Utilization (ERDA)	37,262
Conservation of Materials in Energy Systems (ERDA)	8,781
Various Projects (less than $5,000 each)	794
	$ 747,266
Maritime Transportation Research Board	
Maritime Research Board (NAVY, COMMERCE)	$ 359,324
Ship Hull Research Committee (COMMERCE)	35,816
Ship Research Committee (TRANSPORTATION)	48,334
	$ 443,474
Other	
Committee on Fire Research (NSF, ARMY, COMMERCE, AGRICULTURE)	$ 74,077
Committee on Natural Disaster (NSF, AID)	45,179
Advisory Board on Military Personnel Supplies (ARMY)	156,324
Evaluation of Technology of Sulfur Oxide Emissions (EPA)	78,538
U.S. National Committee for International Institute of Refrigeration (AGRICULTURE)	8,002

SCHEDULE 5
continued

Socioeconomic Effects of Earthquake Prediction (NSF)	$ 22,662		
Study and Technical Evaluation of Coal Gasification Research (INTERIOR)	134,400		
Various Projects (less than $5,000 each)	834		
	$ 520,016		
Total Commission on Sociotechnical Systems Advisory and Research Activities		$ 7,396,893	
Conferences and Symposia			
Transportation Research Board			
Various Projects (less than $5,000 each)	$ 7,900		
Building Research Advisory Board			
Various Projects (less than $5,000 each)	$ 1,425		
Total Commission on Sociotechnical Systems Conferences and Symposia		$ 9,325	
TOTAL COMMISSION ON SOCIOTECHNICAL SYSTEMS			$ 7,406,218
TOTAL GOVERNMENT-FINANCED ACTIVITIES			$47,228,040

Privately Financed Activities

NATIONAL ACADEMY OF SCIENCES

Advisory and Research Activities			
Awards and Prizes (VARIOUS)		$ 7,879	
Copernicus Quinquecentennial Fund		124,775	
Various Projects (less than $5,000 each)		4,042	
		$ 136,696	
Conferences and Symposia			
Academy Forum (VARIOUS)		$ 47,435	
Fellowships and Other Support of Scholars			
Staff Fellowship Program		$ 11,528	
TOTAL NATIONAL ACADEMY OF SCIENCES			$ 195,659

SCHEDULE 5
continued

INSTITUTE OF MEDICINE			
Advisory and Research Activities			
Health Impact of Legalized Abortion (SCAIFE FAMILY FDN., GRANT FDN., POPULATION COUNCIL)	$ 6,244		
Present Medical Malpractice Problem	21,682		
	$ 27,926		
Total Institute of Medicine Advisory and Research Activities		$ 27,926	
Conferences and Symposia			
1976 Anglo-American Conference on Care of Elderly	$ 7,125		
Total Institute of Medicine Conferences and Symposia		$ 7,125	
Fellowships and Other Support of Scholars			
Fellowships in Health Policy (R. W. JOHNSON FDN.)	$ 322,031		
Total Institute of Medicine Fellowships and Other Support of Scholars		$ 322,031	
TOTAL INSTITUTE OF MEDICINE			$ 357,082
ASSEMBLY OF BEHAVIORAL AND SOCIAL SCIENCES			
Advisory and Research Activities			
Study Group on the Impact of Public Broadcasting		$ 16,610	
Committee on Manpower Revenue Sharing Evaluation (FORD FDN.)		245,759	
		$ 262,369	
Executive Office Funds of Assembly of Behavioral and Social Sciences			
Various Projects (less than $5,000 each)		$ 8,653	
TOTAL ASSEMBLY OF BEHAVIORAL AND SOCIAL SCIENCES			$ 271,022

SCHEDULE 5
continued

ASSEMBLY OF ENGINEERING

Advisory and Research Activities

Marine Board		
U.S. National Committee for the International Committee on Oceanic Resources	$ 9,802	
Committee on Minorities in Engineering		
Minority Participation in Engineering Profession	$ 426,477	
Other		
Various Projects (less than $5,000 each)	$ 1,419	
TOTAL ASSEMBLY OF ENGINEERING		$ 437,698

ASSEMBLY OF LIFE SCIENCES

Advisory and Research Activities

Medicine	
Committee on Problems of Drug Dependence	$ 161,508
Twin-Registry Study	16,636
Emergency Airway Management	8,666
Workshop and Clinical Trials of Drugs	9,241
Regional Emergency Medical Communications Systems	109,146
PMA 2nd Workshop on Dermatopharmacology	18,894
Review of Legislation on Food and Drug Regulations	6,011
Various Projects (less than $5,000 each)	3,099
	$ 333,201
Biology	
Food and Nutrition Board	$ 79,936
Institute of Laboratory Animal Resources	25,084
Various Projects (less than $5,000 each)	3,563
	$ 108,583

SCHEDULE 5
continued

International Activities			
U.S. National Committee for the International Union Against Cancer	$ 6,721		
Various Projects (less than $5,000 each)	4,204		
	$ 10,925		
Total Assembly of Life Sciences Advisory and Research Activities		$ 452,709	
Conferences and Symposia			
Medicine			
Drug Dependence Registration Fees	$ 7,075		
Biology			
Various Projects (less than $5,000 each)	$ 1,180		
Total Assembly of Life Sciences Conferences and Symposia		$ 8,255	
TOTAL ASSEMBLY OF LIFE SCIENCES			$ 460,964
ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES			
Advisory and Research Activities			
Division of Chemistry and Chemical Technology			
Various Projects (less than $5,000 each)	$ 8,238		
Division of Earth Sciences			
Various Projects (less than $5,000 each)	$ 3,333		
Division of Mathematical Sciences			
Mathematical Sciences Reserve Fund	$ 6,732		
Various Projects (less than $5,000 each)	3,276		
	$ 10,008		
Division of Physical Sciences			
NAS Film Study	$ 12,130		
Inter-Union Commission on Solar Terrestrial Physics Secretariat	18,476		
Various Projects (less than $5,000 each)	2,100		
	$ 32,706		
Total Assembly of Mathematical and Physical Sciences Advisory and Research Activities		$ 54,285	

SCHEDULE 5
continued

Conferences and Symposia			
Division of Chemistry and Chemical Technology			
U.S. National Committee for the International Union of Pure and Applied Chemistry	$ 20,314		
5th International CODATA Biennial Conference	10,623		
Various Projects (less than $5,000 each)	3,831		
	$ 34,768		
Division of Earth Sciences			
III Congress for International Society for Rock Mechanics	$ 25,606		
Division of Mathematical Sciences			
Various Projects (less than $5,000 each)	$ 1,496		
Division of Physical Sciences			
U.S. National Committee for the International Union of Radio Science	$ 12,468		
Symposium on Structure of Turbulence and Drag Reduction	6,661		
Symposium on 30th Anniversary of ONR	5,471		
Various Projects (less than $5,000 each)	5,401		
	$ 30,001		
Total Assembly of Mathematical and Physical Sciences Conferences and Symposia		$ 91,871	
TOTAL ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES			$ 146,156
COMMISSION ON HUMAN RESOURCES			
Advisory and Research Activities			
Board on Human Resources Data and Analysis			
Various Projects (less than $5,000 each)	$ 2,612		
National Board on Graduate Education			
National Board on Graduate Education	$ 37,323		
Total Commission on Human Resources Advisory and Research Activities		$ 39,935	

SCHEDULE 5
continued

Conferences and Symposia			
National Board on Graduate Education			
Conference for Cooperation Between Graduate Education and Junior Colleges (LILLY ENDOWMENT)	$ 11,094		
National Board on Graduate Education (FORD FDN.)	11,035		
	$ 22,129		
Total Commission on Human Resources Conferences and Symposia		$ 22,129	
TOTAL COMMISSION ON HUMAN RESOURCES			$ 62,064
COMMISSION ON INTERNATIONAL RELATIONS			
Advisory and Research Activities			
Board on Science and Technology for International Development			
Science Cooperative Program with Republic of China International Foundation	$ 45,644		
Various Projects (less than $5,000 each)	329		
	$ 45,973		
Total Commission on International Relations Advisory and Research Activities		$ 45,973	
Fellowships and Other Support for Scholars			
U.S.-Brazil Program of Graduate Research and Teaching in Chemistry (SLOAN FDN., DUPONT)	$ 6,133		
Various Projects (less than $5,000 each)	2,797		
	$ 8,930		
Total Commission on International Relations Fellowships and Other Support for Scholars		$ 8,930	
TOTAL COMMISSION ON INTERNATIONAL RELATIONS			$ 54,903
COMMISSION ON NATURAL RESOURCES			
Advisory and Research Activities			
Board on Agriculture and Renewable Resources			
Various Projects (less than $5,000 each)	$ 4,285		

SCHEDULE 5
continued

Environmental Studies Board			
Committee of International Environmental Programs (ANDREW W. MELLON FDN., HOLCOMB RESEARCH INSTITUTE)	$ 101,542		
Global Environment Monitoring System	9,607		
Environmental Studies Board	14,864		
	$ 126,013		
Total Commission on Natural Resources Advisory and Research Activities		$ 130,298	
TOTAL COMMISSION ON NATURAL RESOURCES			$ 130,298

COMMISSION ON SOCIOTECHNICAL SYSTEMS

Advisory and Research Activities

Transportation Research Board			
Railway Research Information Service	$ 44,316		
Highway Research Board	1,868,566		
Demand Response Conference	16,843		
Various Projects (less than $5,000 each)	10,455		
	$1,940,180		
Building Research Advisory Board			
Building Industry Manufacturers Research Council	$ 12,876		
Building Research Advisory Board	11,306		
	$ 24,182		
National Materials Advisory Board			
Fire Safety Aspects of Polymeric Materials	$ 4,999		
Maritime Transportation Research Board			
Ship Hull Research Committee	$ 11,085		
Other			
Conference on Electrical Insulation and Dielectric Phenomena	$ 53,194		
Committee on Fire Research	29,603		
	$ 82,797		
Total Commission on Sociotechnical Systems Advisory and Research Activities		$2,063,243	

SCHEDULE 5
continued

Conferences and Symposia			
Transportation Research Board			
Various Projects (less than $5,000 each)	$ 7,536		
Building Research Advisory Board			
Various Projects (less than $5,000 each)	$ 2,550		
Other			
U.S. National Committee for the International Institute of Refrigeration	$ 7,778		
Symposium on Methods for Food Evaluation	12,825		
National Cooperative Highway Research Program	38,973		
	$ 59,576		
Total Commission on Sociotechnical Systems Conferences and Symposia		$ 69,662	
TOTAL COMMISSION ON SOCIOTECHNICAL SYSTEMS			$2,132,905
TOTAL PRIVATELY FINANCED ACTIVITIES			$4,248,751

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APPENDIX VI

PUBLICATIONS, FISCAL YEAR 1976

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